OFFICIAL PUBLICATION OF THE PROCEEDINGS AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

JANUARY 8, 1951
VOLUME 40, NO. 1

AMERICAN DYESTUFF REPORTER

DEVOTED TO TEXTILE CHEMISTRY • BLEACHING • DYEING • PRINTING • FINISHING

STILL THE BEST OPTICAL BLEACH FOR THE MILL

Tinopal BVA

Since the introduction of Tinopal* B V A by Geigy other optical bleaches have appeared on the market, many of them extremely meritorious for certain purposes. However, *for the mill* running vegetable fibres (cotton, linen, viscose rayon, or hemp) Tinopal B V A still is pre-eminent—a "stand-out" in the field of optical bleaches.

The booklet "Tinopal B V A" tells the story in mill language — what it is, how and where it may be applied most effectively and what to expect of it (both in the written word and graphic illustrations).

Send for booklet "Tinopal B V A" and a small sample. It will be all you will need for a practical trial.

* *Registered U. S. Patent Office*

Geigy

Dyestuff Makers Since 1859

GEIGY COMPANY, Inc.

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IN GREAT BRITAIN: The Geigy Co., Ltd., National Buildings, Parsonage, Manchester

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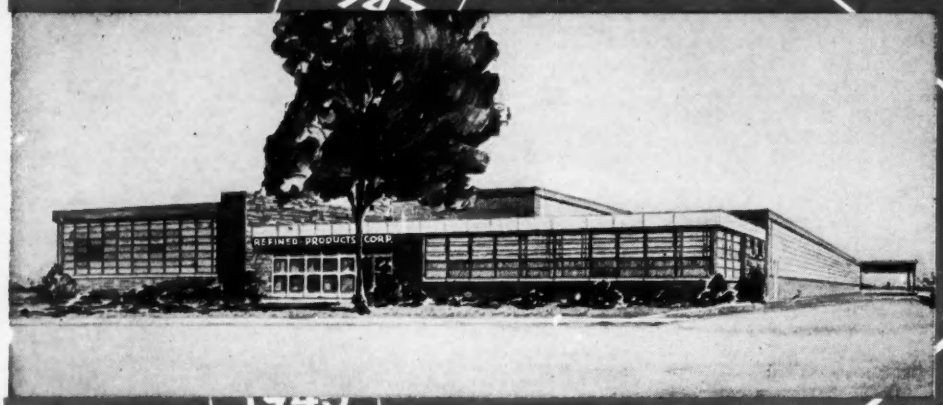

Our customers profit by our expansion

Extensive chemical research laboratories and ultra modern processing equipment produce better products more economically.

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In the Neolan-best-for-wool tradition, these new colors dye fast and level, are simple to apply, and are easy to shade.

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Neolan Green 8G

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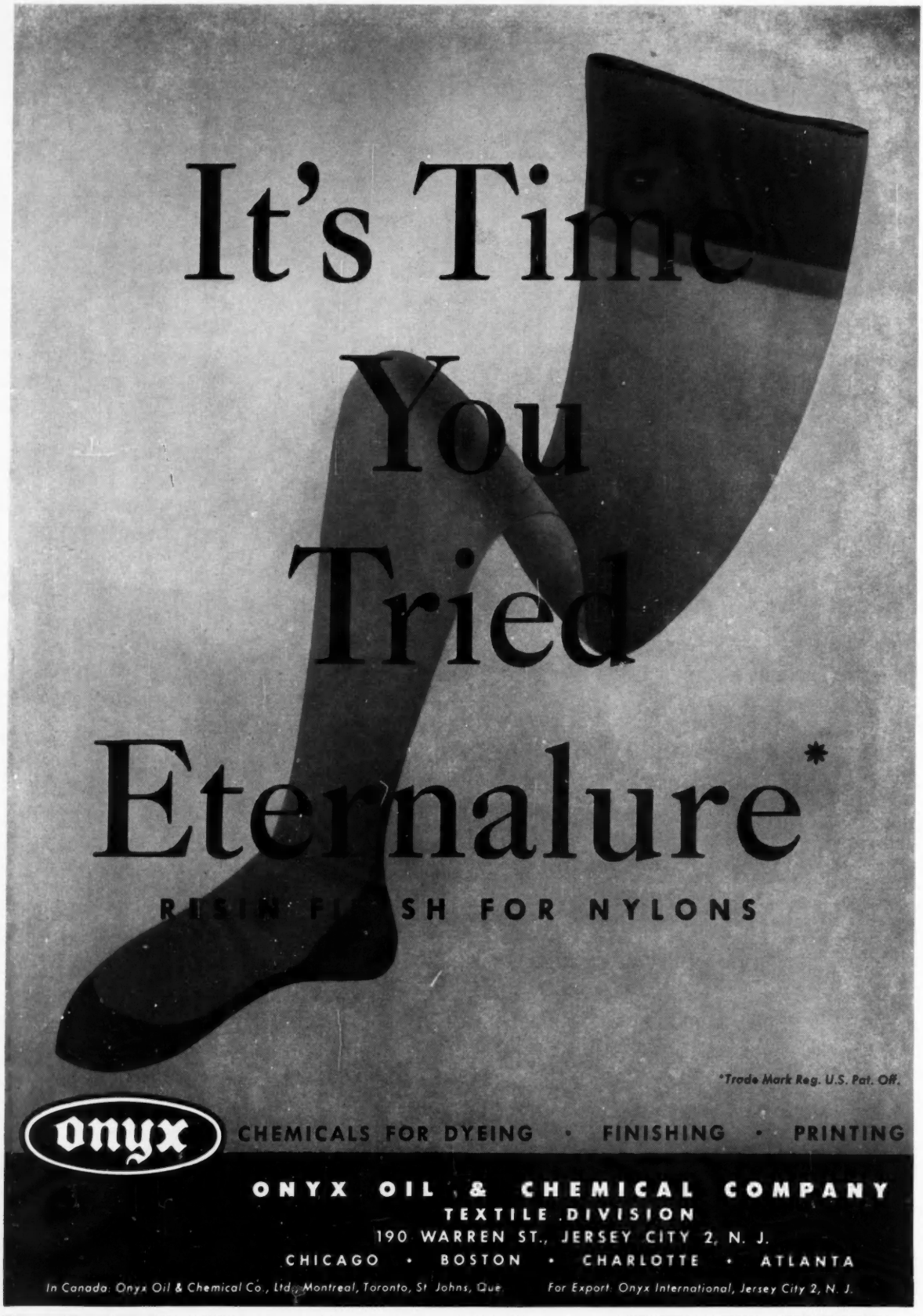
It's Time
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One sure step towards consistent color satisfaction in dyeing and printing is to investigate the A.A.P. textile auxiliaries listed below. Technicians from our nearest branch will be happy to show how each has helped leading dyers, finishers and printers... *how each can help you.*

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*Reg. U. S. Pat. Off.

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A SYNTHETIC SURFACE-ACTIVE COMPOUND

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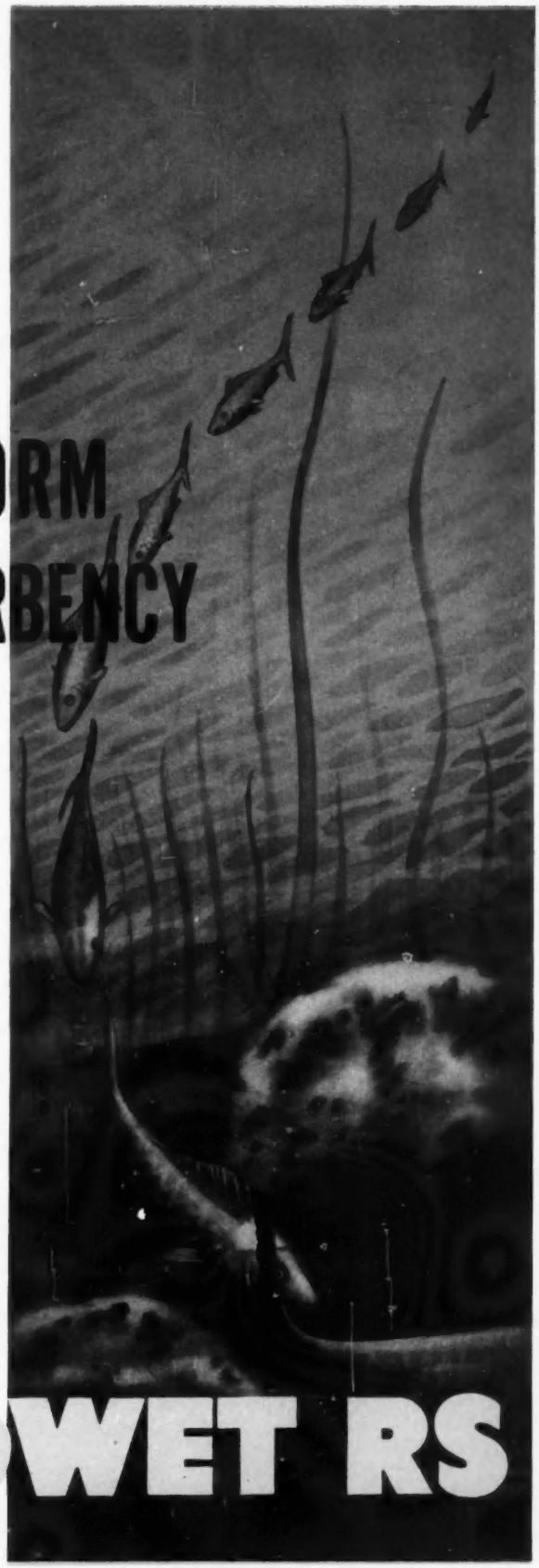

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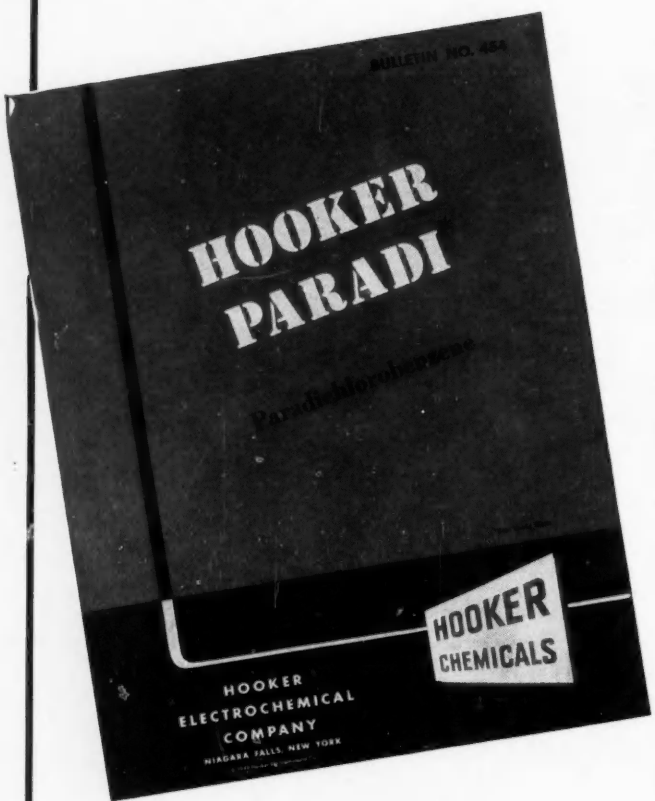
with Hooker Paradichlorobenzene



HOOKER's new Bulletin No. 454 on Paradichlorobenzene can be your guide to increased sales and profits if you are interested in the fumigant, deodorant and disinfectant markets. It describes the many uses and application of paradichlorobenzene, methods for reforming and repackaging—contains a table and illustrations of exact screen sizes—just the information a repackager or specialty manufacturer needs.

Hooker Paradichlorobenzene is a crystal clear, high purity product that evaporates completely, leaving no residue and no stains. It is not injurious to fabrics, furs or hides and is not poisonous to human beings.

It is made available in seven graduated sizes from powdered to Pea No. 1 (Screen size through $\frac{5}{8}$" on $2\frac{1}{2}$).

TYPICAL PROPERTIES
HOOKER PARADICHLOROBENZENE

Appearance	White to clear transparent
Form	Crystals in 7 sizes
Melting Point	53°C
Boiling Point	173°C
Residue on Sublimation	None
Shipping Containers	25, 50, 100, 200 lb. Fibre Drums

A request on your company letterhead will bring this bulletin to you promptly. Chemists who are interested in other physical and chemical properties should ask for Technical Data Sheet 749.

*TRADE MARK REGISTERED

From the Salt of the Earth

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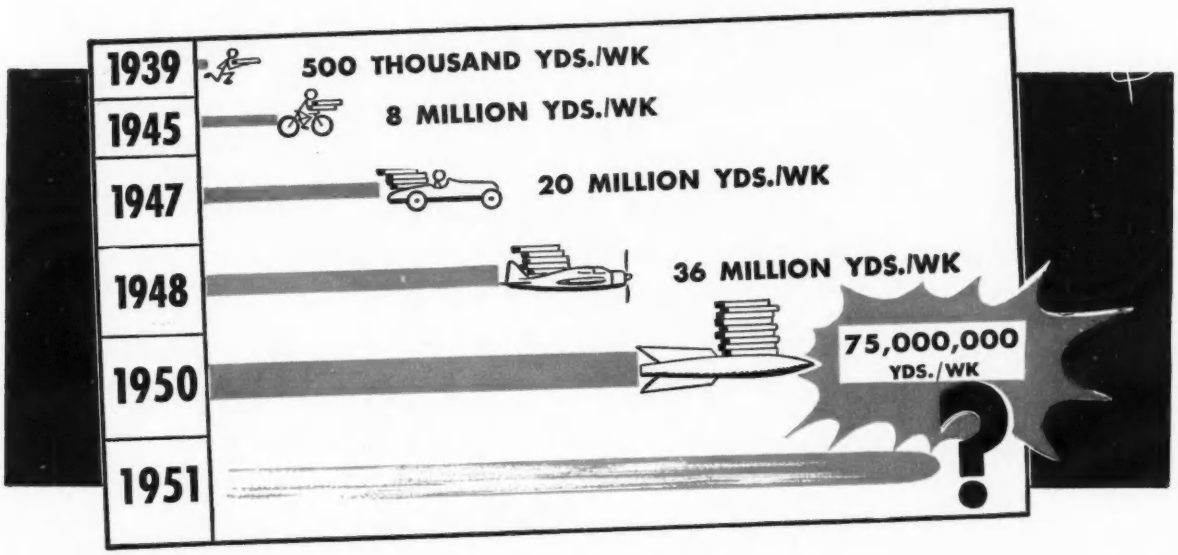
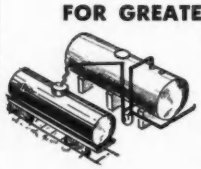


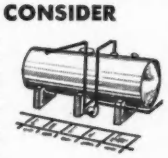
Sufficient capacity to bleach more than ½ of the annual production of cotton piece goods in the United States! That's the potential of Du Pont Continuous Bleaching Systems now in operation or under construction. And latest total production figures indicate an output of seventy-five million yards per week from present installations . . . a meteoric increase over the figure established in 1939, when Du Pont's first units were put into commercial operation.

FOR GREATEST ECONOMY CONSIDER



Tank Car Deliveries

If you need 5000 lbs. or more of "Albone" 35 or "Albone" 50 Hydrogen Peroxide per month, you'll find a storage tank installation economical. For smaller consumers in Metropolitan New York, Boston, Philadelphia, tank truck deliveries can be made.



Tank Storage at the mill

Since 1939, continuous bleaching has become well-established throughout the world as the modern way to speedy, economical, high-quality bleaching. Today, systems of all types are available to meet the specific requirements of any textile mill, large or small.

Why not investigate the advantages of Continuous Bleaching for your mill? Du Pont will be pleased to work with you . . . study your requirements . . . help you select proper equipment and assist in many other ways. Send for our new book that illustrates typical installations and gives other important information. Write to E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Dept., Wilmington 98, Delaware.

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DU PONT

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Please send me more information about Du Pont Continuous Peroxide Bleaching Systems.

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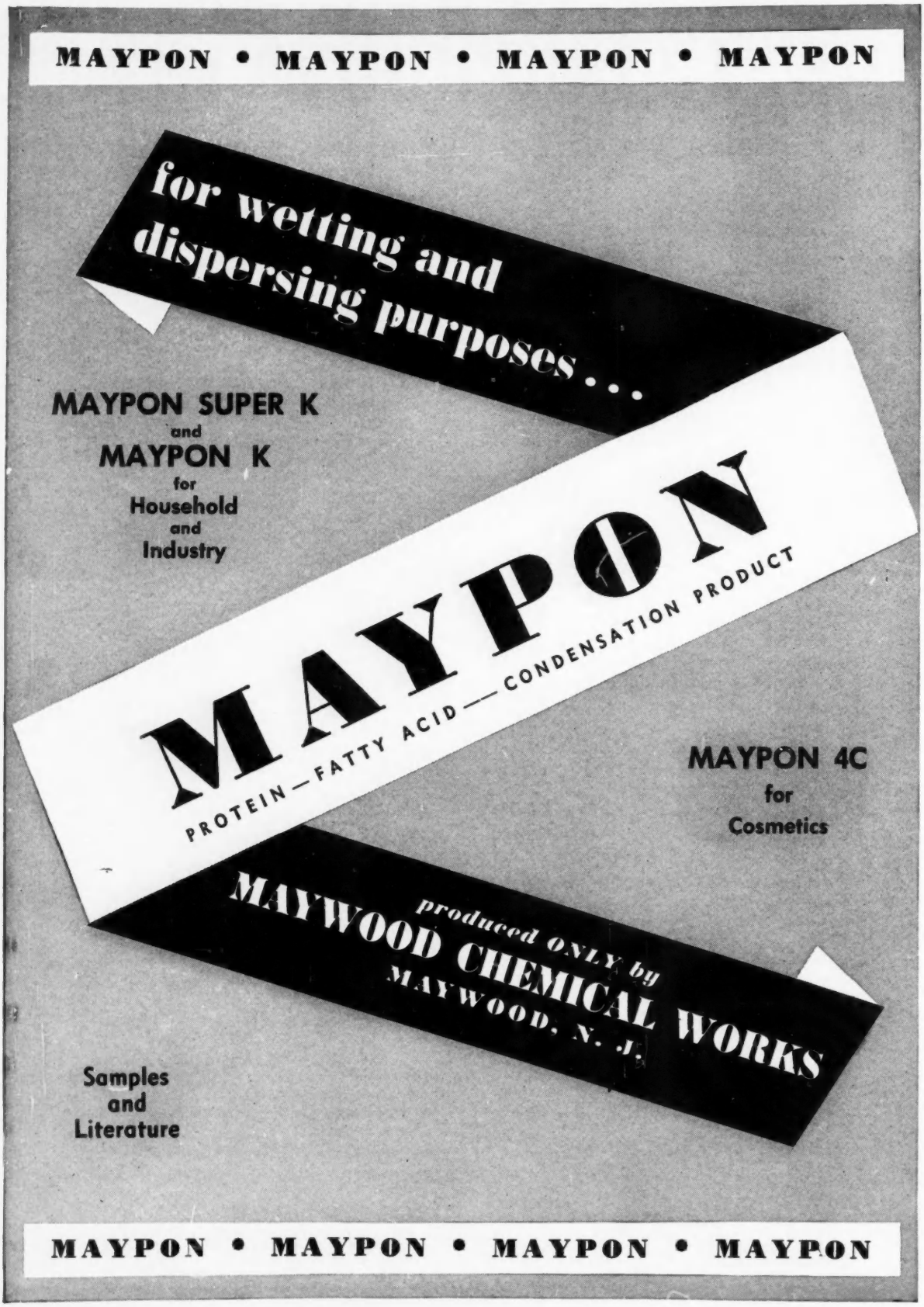
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fast colors on cotton, rayon and linen

brilliant colors outstanding for clarity and depth.

extensive color range many important shades are exclusively GDC.

fastness excellent fastness to washing—very good fastness to light.

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A DURABLE GAS-FADING INHIBITOR

ARIPERM P M

Gives fabrics composed partially or wholly of

Acetate Rayon

— lasting protection against fading from atmospheric gases

— with excellent resistance to *WASHING AND DRY CLEANING*

Recommended for dyeing Light Shades, Pastels & Tints as well as medium and heavy shades.

With Ariperm P M there is no appreciable yellowing effect on white goods when exposed in the gas chamber — relatively little effect on light fastness of the color.

Simple application in scouring or directly in the dye bath.

Write for Technical Service Bulletin #201-121.1

Photograph courtesy Celanese Corporation of America. Yarn content: Warp — Celanese acetate rayon dull filament; Filling—Celanese acetate rayon bright staple.

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NEWARK, NEW JERSEY

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- Sulfan* (Stabilized Sulfuric Anhydride)
- Acetic Acid
- Sodium Silicate
- Aqua Ammonia
- Hydrochloric Acid (Muriatic Acid)
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- Sodium Tripolyphosphate
- Sodium Metasilicate
- Sodium Sulfite, Anhydrous
- Sodium Bisulfite, Anhydrous
- Oxalic Acid
- Aluminum Chloride, Solution
- Disodium Phosphate, Anhydrous
- Nitre Cake (Sodium Bisulfate)
- Trisodium Phosphate
- Sodium Thiosulfate (Hypo)
- Aluminum Sulfate
- Lead Acetate
- Mixed Acid
- Epsom Salt
- Chrome Alum
- Ammonia Alum
- Potash Alum
- Ammonium Sulfate

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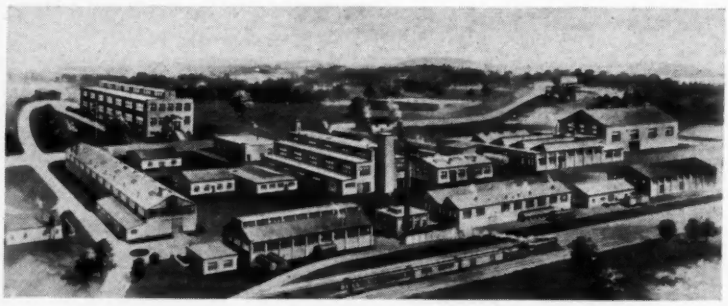

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- Benzyl Chloride
- Ortho-Chlorobenzyl Chloride
- Para-Chlorobenzyl Chloride
- 2,4-Dichlorobenzyl Chloride
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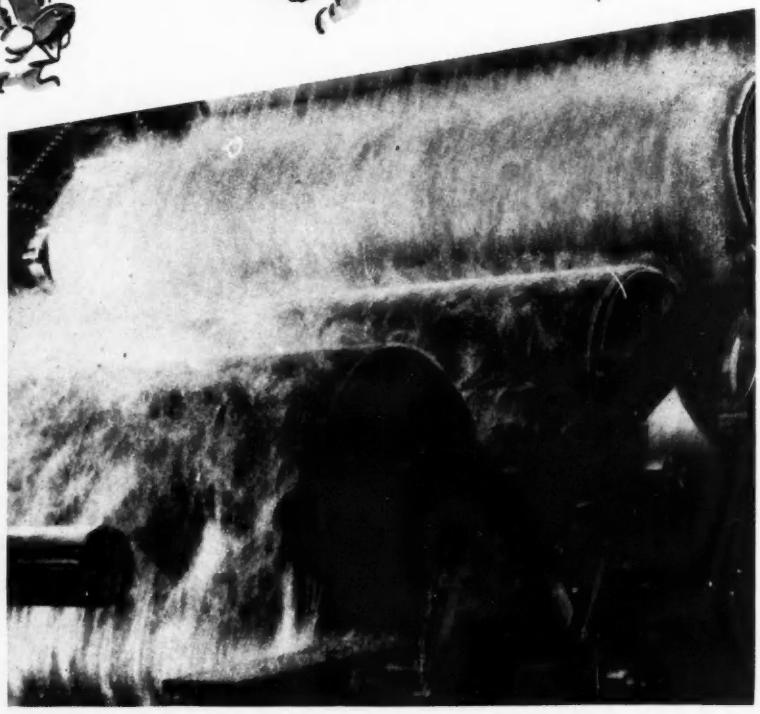
Easy scouring

Static-free

Easy to apply



But they'll all agree on one essential—***the oil must undergo no change in storage.*** It must not heat up, develop unpleasant odors, or discolor. And it must scour easily, regardless of the storage period.

That's something you can bank on when your mill starts using Proxol!

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• *made by the makers of Olate the industry's leading all-purpose textile soap...*

Proxol undergoes no change when it's on your raw wool, yarn or fabric. It won't heat up in storage. You won't have to worry about odor or discoloration. And Proxol scours out easily.

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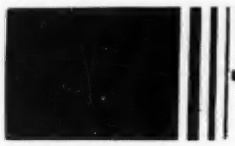
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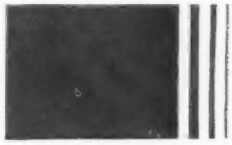
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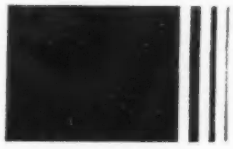
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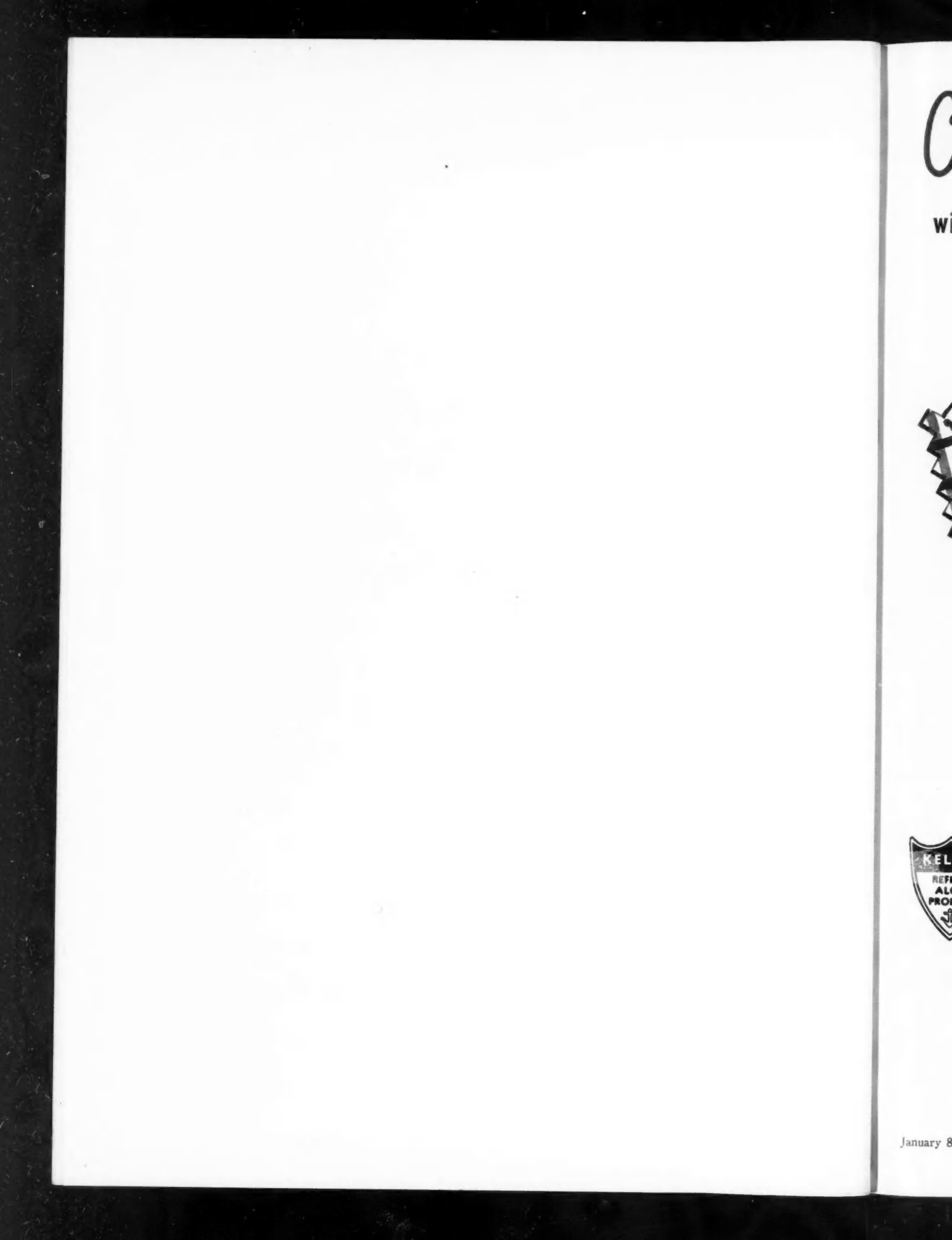

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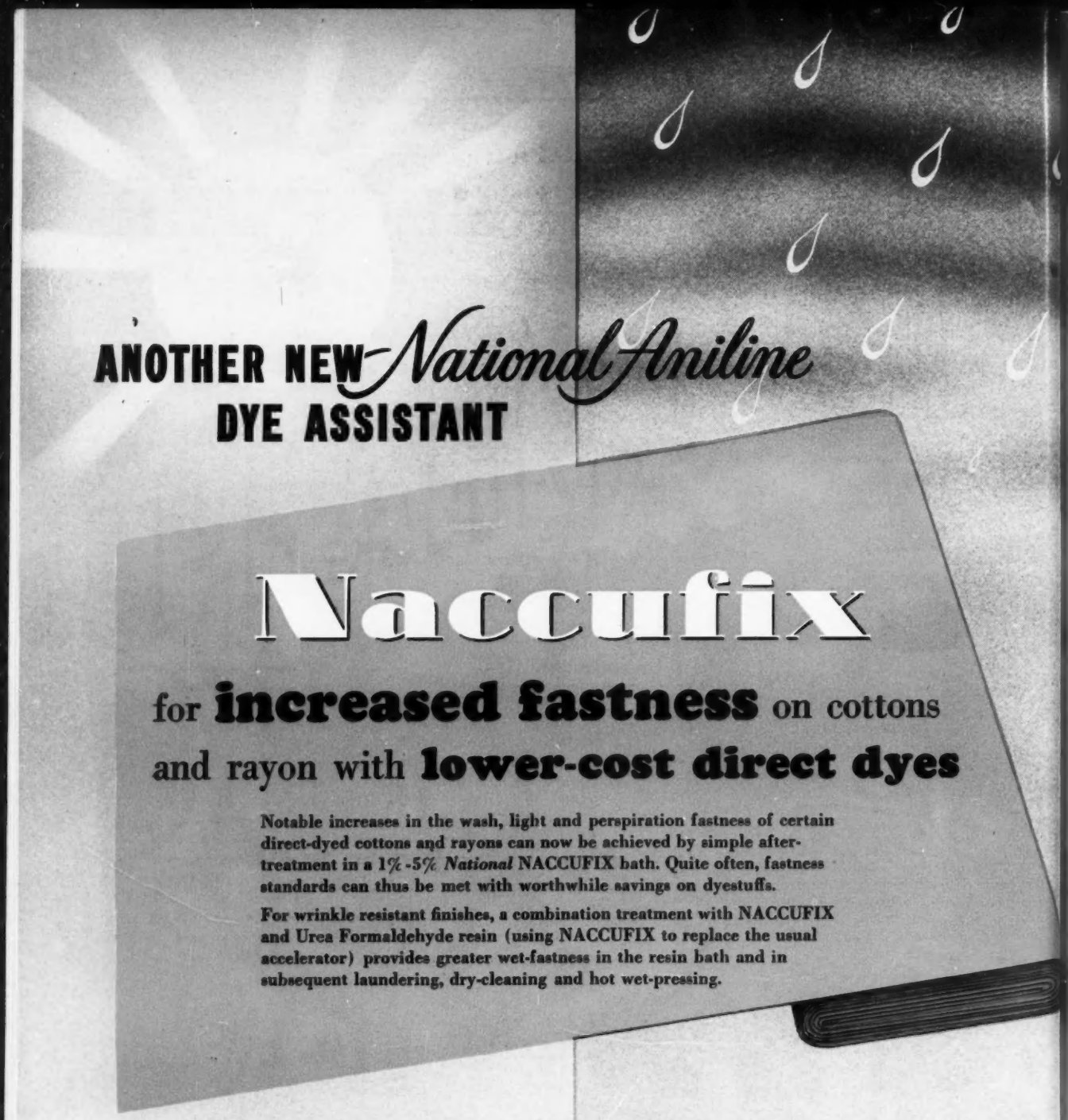

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THE HYDROGEN PEROXIDE DRY-IN PROCESS FOR BLEACHING WOOL

E S SHANLEY, H O KAUFFMANN and W H KIBBEL

Research Department
Buffalo Electro-Chemical Company, Inc.

This is a study of the hydrogen peroxide dry-in process for bleaching wool. The process is shown to be simple and economical, and very suitable for wool to be dyed. However, hydrogen peroxide bleached wool is especially susceptible to darkening during dyeing unless suitable precautions are taken to destroy residual peroxide traces.

Practical methods are described by which to obtain the best bleaching results and the brightest dyeings.

INTRODUCTION

HYDROGEN peroxide is the foremost wool bleaching agent. Several different methods of application are in widespread use, chief among these being the immersion bleach, the steep and the dry-in methods. The first two consist essentially of saturating the woolen material with weakly alkaline hydrogen peroxide solution for a period from 1 to 24 hours and then removing the solution by washing. The dry-in process, applied only to wool stock, involves impregnation with hydrogen peroxide solution followed by drying. No washing step is required. The dry-in process does not give as great a degree of bleach as the other processes, but has the advantages of simplicity and economy as well as the advantage of being a continuous process. A large fraction of the wool bleached in this country is processed by the dry-in method.

Despite the commercial importance of this latter process, no survey or evaluation has appeared in the literature. The present article is a review of the process as actually operated in the mill, and an appraisal of the properties of the bleached wool.

THE HYDROGEN PEROXIDE DRY-IN PROCESS

When the hydrogen peroxide dry-in process is carried out, the bleaching chemicals are added at the end of the scouring train and allowed to dry in the wool. This method of bleaching is presently used only following the aqueous scouring process. Depending upon the particular mill, one, two or three bowls are used for treating the grease wool with soda ash and/or phosphates in combination with soap or synthetic detergents. The scouring bowls are followed by at least one rinsing bowl supplied with clear water. The rinsed wool then falls into the bleaching bowl carrying along a small amount of alkali and detergent.

Hydrogen peroxide and sulfuric acid are fed to the bleaching bowl by means of siphons and calibrated orifices or, preferably, by the use of proportioning pumps. Depending upon the degree of bleach desired, the solution in the last bowl may be kept anywhere from about 0.3% to 0.9% in hydrogen peroxide content (one to three volume bath).

The sulfuric acid feed is adjusted to keep the bleaching solution on the acid side, usually in the range of pH 3 to pH 5. Sometimes the titratable acidity is measured; this generally runs one hundredth normal or less. A water extract from dry-in bleached wool is usually much less acid than the bleach bath, in fact, often being slightly alkaline in reaction. Thus, the wool does not reach equilibrium with the acid in the last bowl.

Drying may be carried out at temperatures up to 200°F. in a few minutes' time or lower temperatures may be used with correspondingly longer time. Wool entering the dryer usually carries somewhat less than its own weight of solution, while the dried material contains from 10% to 20% moisture. Most of the bleaching takes place during the drying operation.

PROPERTIES OF HYDROGEN PEROXIDE DRY-IN BLEACHED WOOL

Dry-in bleached wool is not much changed in handle or in general appearance except for the lightening in color. As in the case of unbleached wool, ether extractables are often kept near 0.5% by proper control of the scouring stages.

The color of dry-in bleached wool ranges from near white to medium brown, depending upon the original color of the wool and upon the amount of hydrogen peroxide used.

TABLE I

EFFECT OF DRY-IN BLEACHING ON THE BRIGHTNESS OF WOOL
Bleach bath 0.45% H_2O_2 (1.5 volume)

	Brightness Before Bleaching	*Brightness After Bleaching*	*Bleach Response*
Light Colored Wool	44.8	49.5	4.7
Medium Blend	39.9	45.8	5.9
Dark Blend	36.8	41.6	4.8

TABLE II

COLOR REVERSION DURING MOCK DYEING OF WOOL

Wool Sample		*Brightness (% Reflectance for Hunter Blue Light)*
Unbleached	No further treatment	40
	Mock dyed	36
Bleached*	No further treatment	46
	Aged one day, mock dyed	36
	Aged two weeks, mock dyed	39
	Hydrosulfite treated, mock dyed	40
	Yeast treated, mock dyed	40

* Two volume (0.6% H_2O_2) dry-in bleach.

As a practical, simple method for color specification, it was decided that the reflecting power of the samples for blue light be measured as has been done for many years in the case of paper products. This is an incomplete color specification, but its use may often be justified in the case of natural products predominantly yellow or brown in color. In many cases, only lightness and colorimetric saturation are affected by bleaching, leaving the hue unchanged. Under these circumstances, it is not unreasonable to use the blue reflectance as a quantitative measure of the degree of bleach. This method of color specification also has the practical advantages of being simple and readily understood.

For the present study, it was decided to use the percent reflectance of the material for light from the Hunter blue tristimulus filter, as measured with a Hunter Multipurpose Reflectometer. Yarn samples were used almost exclusively for these measurements, because of the difficulty in getting wool stock into the form of flat plaques for measurement. The yarn was wound two layers deep on plywood forms about three by four inches in size. Yarn direction was held vertical to the instrument in all cases. Reported measurements are generally the mean of eight or ten reflectance determinations on a single such plaque.

This measuring procedure required the use of yarn throughout most of the work. However, no systematic differences were found between the behavior of yarn and stock in a large number of comparative tests. This was deemed sufficient justification for the use of yarn even though this investigation was devoted to a process where the wool is normally in stock form.

Typical reflectance measurements on wool yarn are shown in Table I. In all cases, the term "brightness" refers to the percent reflectance of the samples for the Hunter blue light (magnesium oxide =100%). The bleach response ΔB, is the difference in the reflecting power before and after bleaching.

Dyeing qualities of the bleached wool are of primary importance, since most dry-in bleaching is carried out on stock which is to be dyed. It is possible to get substantially brighter and purer shades on bleached wool, especially in the case of shades like the light blues and greys.

TABLE III

EFFECT OF DYEING CHEMICALS AND TEMPERATURE ON COLOR REVERSION

Salt	°C	*Acid*	ΔB*
5% Na_2SO_4	56	No Acid	−0.3
		4% Acetic Acid	+0.4
		0.5% H_2SO_4	+0.4
	80	No Acid	−4.4
		4% Acetic Acid	−2.2
		0.5% H_2SO_4	−2.2
	100	No Acid	−8.7
		4% Acetic Acid	−10.3
		0.5% H_2SO_4	−10.4
No Na_2SO_4	56	No Acid	0.0
		4% Acetic Acid	+1.3
		0.5% H_2SO_4	−0.2
	80	No Acid	−0.1
		4% Acetic Acid	−1.9
		0.5% H_2SO_4	−1.9
	100	No Acid	−9.9
		4% Acetic Acid	−10.0
		0.5% H_2SO_4	−10.6

*ΔB, the change in brightness = (% reflectance before mock dyeing) — (% reflectance after mock dyeing).

For example, a 0.1% dyeing with Alizarin Sapphire BN (C.I. No. 1054) on a certain light, unbleached stock gave a shade which matched Munsell 10BG 6/3. A similar dyeing on the same stock after 0.6% hydrogen peroxide (2 volume) dry-in bleach matched Munsell 5.0 B 6.5/4.

Dry-in bleaching does not produce complete decolorization, hence it is not possible to obtain all shades on any feed stock. The lightest shades may require reasonably light raw stock. However, the range of raw stock for a given shade can be greatly expanded by proper application of the dry-in bleaching process.

THE PROBLEM OF COLOR REVERSION DURING DYEING

It is well known that wool darkens in color upon treatment at high temperature. Unbleached wool is very appreciably darkened by treatment in boiling water for one hour. It was observed, however, that wool freshly bleached by the peroxide dry-in process showed abnormally great reversion at the boil, often dropping below the color of unbleached boiled samples. Actual dyeings with acid dyes confirmed these findings, the bleached wool often coming out duller and yellower than the unbleached.

EFFECT OF RESIDUAL HYDROGEN PEROXIDE———In the course of the present investigation, it was shown that this abnormal reversion did not occur if the wool was aged (i.e., allowed to stand at room temperature) before dyeing. Treatment with reducing agents or with hydrogen peroxide decomposition catalysts also prevented abnormal reversion. Of the reducing agents tried, sodium hydrosulfite proved most advantageous. It was applied in the form of a dilute solution using a few minutes' immersion at room temperature. About 0.2% sodium hydrosulfite, based on the wool, gave satisfactory results in many cases. This treatment was followed by a water rinse.

The enzyme catalase, in the form of a yeast slurry, was successfully employed as a peroxide decomposition catalyst. The bleached wool for treatment was immersed for a few minutes in a slurry containing 0.2% yeast paste (based on weight of wool), then rinsed in water before dyeing.

A quantitative measure of these effects was obtained by subjecting wool skeins to the so-called mock dyeing procedure, in which the wool was treated in a typical acid dyebath containing all the constituents except the dyestuff. In these trials the baths were made up with 5% Glauber's salt, 4% acetic acid, and 0.5% sulfuric acid, based on the weight of wool. The mock dyeings were carried out at a

TABLE IV

EFFECT OF TEMPERATURE ON COLOR REVERSION OF BLEACHED WOOL

Temperature °C.	*Mean ΔB Data From Table III*
56	0.0
80	2.3
100	9.9

50 to 1 liquor ratio for 60 minutes at the boil. The rinsed and dried yarn was wound on 3 x 4 plywood sheets. These "plaques" were used to measure percentage reflectance with the Hunter Multipurpose Reflectometer. Results are listed in Table II.

As shown by the data, the unbleached wool yarn lost about four brightness points during mock dyeing. The freshly bleached (1 day old) yarn dropped more than twice as much, thus loosing the whole bleach response. The bleached yarn which was aged before mock dyeing retained a four point advantage over the unbleached yarn. As shown, the bleached yarn treated with yeast or treated with a reducing agent retained even somewhat greater advantage over the unbleached yarn. It should be noted here that the advantage shown by the reduced sample was not due to any bleaching action exerted by the reducing agent. Wool can be lightened by this reagent, but no significant color change was produced under the conditions used in the present reducing treatment.

Actual dyeings were also made on wool samples corresponding to those listed in Table II. The results were even more striking than the mock dyeing results. Especially in the case of blue dyeings, the bleached samples which had been freed from residual peroxide gave extraordinarily bright and clear dyeings. For example, a series of 0.1% dyeings with Alizarin Sapphire BN were found to match the following Munsell colors.

Unbleached wool	10 BG 6/4
Freshly bleached wool.....	10 BG 6.5/2
Bleached wool treated to remove residual peroxide	5.0 B 7/4

Thus, the unbleached wool dyed much greener than the bleached and after-treated wool sample, while the freshly bleached wool dyed both greener and weaker.

The following facts shed some additional light on the properties of bleached wool:—

Dyeing qualities have been found to improve steadily with age after bleaching for as long as three weeks in extreme cases. Water rinsing after bleaching has little effect, but prolonged washing in running water does prevent abnormal reversion during dyeing. Intentional addition of hydrogen peroxide to mock dyebaths causes wool to darken very severely during one hour at the boil.

All of the facts above seem consistent with the hypothesis that dry-in bleached wool retains some traces of peroxide for a considerable time after bleaching. During this time interval, abnormal color reversion will be observed upon dyeing. Aging the wool or treating it by the methods outlined above serves to eliminate the peroxide traces and thus prevent reversion during dyeing.

The above explanation is only tentative since it has not yet been possible to show a correlation between the abnormal reversion and chemical tests for hydrogen peroxide on the bleached wool.

Maximum convenience in plant operation is offered by the process developed during this investigation, of adding a reducing agent directly to the dyebath just before entering the wool. It has been found that about 0.1% sodium hydrosulfite, based on the wool weight, is tolerated by many acid dyestuffs and usually has sufficient reducing power to control the color reversion. The technique has been found to give excellent results, in the laboratory and in the dyehouse.

EFFECT OF DYEING CHEMICALS AND TEMPERATURE———An additional series of tests was made to elucidate the relations between color reversion and various factors in the dyeing process. Small skeins were bleached by the dry-in process for these tests. The skeins were wet out in a 0.60% hydrogen peroxide bath, 0.01 normal in sulfuric acid, at a 200 to 1 liquor ratio. After being squeezed to about 1 to 1 liquor ratio, the skeins were dried for 30 minutes in a mechanical convection oven at air temperature 60°C. These skeins were mock dyed about two days after bleaching. The mock dyebaths contained various portions of an acid dyeing formula. After mock dyeing the skeins were rinsed and dried, then wound on plywood forms for measurement of the brightness (Hunter blue reflectance).

The experimental plan together with the brightness data is shown in Table III.

A statistical analysis of these data indicated that the salt, acetic acid, and sulfuric acid had a negligible effect on the amount of color reversion. Thus, heating wool in plain water may be expected to cause about as much reversion as heating in a dyebath. The temperature effect was found to be highly significant, both statistically and practically (Table IV).

Since high temperature has been found so detrimental to the color of wool, it is desirable to dye at the lowest practicable temperature, especially in the case of pastel shades. Many wool dyes are satisfactory for use at dyeing temperatures well below the boil, a fact which has been amply demonstrated by the excellent dyeings obtained at 80°C. during the course of the present investigation.

EFFECT OF TIME IN THE DYEBATH———A set of wool skeins was bleached by the dry-in process using a 0.60% hydrogen peroxide bath, 0.01 N in sulfuric acid. The samples were mock dyed in a bath containing 5% sodium sulfate, 4% acetic acid and 0.5% sulfuric acid. The skeins were entered into the boiling mock dyebath, held therein for the stated times, removed, rinsed, and air dried. Reflectance measurements were made as previously described. The results are presented in Table V.

Since much of the reversion occurs in the early part of the dyeing, it is probably not feasible to completely control this effect by shortening the dyeing time. Nevertheless, for bright shades the time in dyeing should be kept to a minimum.

TABLE V

EFFECT OF TIME IN DYEBATH ON COLOR REVERSION OF BLEACHED WOOL

Minutes at 100°C.	*ΔB*
0	0
5	2.3
15	4.3
30	5.7
60	6.8

EFFECT OF HYDROGEN PEROXIDE ON WOOL DYESTUFFS

In view of the foregoing evidence that hydrogen peroxide may sometimes be carried into wool dyebaths via the bleached wool, it was decided to investigate the possible effects of this reagent on a few wool dyes. Accordingly, acid dyebaths were made as though for 0.1% dyeings, containing 5% anhydrous sodium sulfate, 4% acetic acid, 0.5% sulfuric acid and 0.1% dyestuff, at 50 to 1 liquor ratio, all based on the wool weight. However, no wool was entered. These baths were dosed

TABLE VI

EFFECT OF HYDROGEN PEROXIDE ON WOOL DYES

mg. H_2O_2 Per Liter of Dyebath	Portion of Original Dye Remaining After One Hour's Boil		
	Fast Acid Violet GRF C.I. 758	Alizarin Cyanone GN C.I. 1078	Alizarin Sapphire BN C.I. 1054
30	8%	6%	1%
150	5%	6%	0%

with hydrogen peroxide and then heated to boiling for one hour. (See Table VI).

Change in the amount of dyestuff was estimated by measuring the color of the solutions before and after heating, using a photoelectric colorimeter.

Since these wool dyes were severely attacked by hydrogen peroxide, it seems doubly important that peroxide be eliminated from bleached wool before dyeing, both to protect the dyestuff and to protect the wool from abnormal color reversion.

SUMMARY

The hydrogen peroxide dry-in process offers a simple and economical method by which to improve the color of wool stock. Impregnation of the wool is carried out in a rinsing bowl at the exit end of the regular scouring train. The solution in this bowl is kept at about 0.3% to 0.9% in hydrogen peroxide content (1 to 3 volume bath) depending upon the degree of bleach desired, while the acid feed is adjusted so that the wool is neutral or faintly alkaline leaving the dryer. Drying and subsequent processing are carried out in the customary fashion.

Medium colored wools often reflect about 40% of the incident blue light. Depending upon the wool stock and the amount of hydrogen peroxide used, this can be increased to around 45% to 50% by application of the dry-in process. The bleached wool looks considerably lighter, but the improvement is much more marked after dyeing. Especially in the case of light blue and light grey dyeings, the colors are strikingly brighter and purer if properly dyed on a bleached stock.

Optimum results in the dyeing of peroxide dry-in bleached wool can be obtained by observance of the following two general principles.

(a) Precautions should be taken to insure the complete absence of hydrogen peroxide before dyeing. This may be accomplished by aging the bleached wool before dyeing, by treating the bleached wool with small amounts of reducing agents or by treating the bleached wool with materials, otherwise harmless, which will catalyze decomposition of hydrogen peroxide. It is also feasible to add a small amount of reducing agent directly to the dyebath.

(b) Bleached wool should be dyed at the lowest practicable temperature. Wool always darkens when treated at 100°C. and this is especially objectionable when bright, light shades are the goal. Many wool dyeings can be carried out with excellent results at around 80°C., where color reversion is much less severe.

• PATENT DIGEST •

FLAMEPROOFING——GLYCOL MONOSULFATE G, 2, 03

U. S. Pat. 2,511,911

(Gavatin—Fuchs—June 20, 1950)

This specification relates principally to flameproofing processes for paper, but evidently conclusions may be drawn in the field of textile processing. The inventor states that effective flameproofing agents must be capable of complete dehydration, characterized by the fact that carbon and water finally result as dehydration products.

It has been found that inexpensive glycolmonosulfates can be used for this purpose. Only glycol compounds having a ratio of carbon to OH = 1 : 1-2 may be selected, however. Thus, low glycols, such as ethylene glycol, propylene glycol, trimethylene glycol, etc., in the form of their sulfates are recommended, while higher alkylsulfates generally applied as surface active agents are not suitable.

The treatment of ethylene glycol with sulfuric acid must be carried out at low temperatures up to 40°C. in order to avoid dark by-products. Swelling of paper, impregnated according to this method has been observed.

References cited by the Patent Office, among others:

PAUL WENGRAF

U. S. Pat. 2,091,956 (Du Pont, 1937): higher glycol sulfates (e.g., dinonyl ethylene glycol sulfate), prepared by treating the glycols with sulfuric acid, as detergents, emulsifying agents, etc.

U. S. Pat. 2,264,737 (Hyalsol Corp.—Bertsch—1941): production of higher alkylsulfates of Gardinol (Duponol) type by reacting the higher alcohols with sulfonating agents. These compounds are especially recommended as detergents and generally as surface active agents.

WATER REPELLENT TEXTILES——Velan (Zelane) and Dimethylolurea, Applied with Excess Formaldehyde G, 2, 02

U. S. Pat. 2,512,195

(Bener—June 20, 1950)

The preamble of this specification states that treating textiles with mixtures of octadecyl oxymethyl pyridinium chloride (or other compounds of the Velan or Zelane type) plus aldehyde-amino condensates under acidic conditions is well known for waterproofing, shrinkproofing and creaseproofing textiles. These processes are said to have the drawback of tendering the material, probably because of a considerable reduction in elasticity (increasing brittleness of the fibers). The inventor found that a substantial improvement can be attained by using Zelane, dimethylolurea and an excess of formaldehyde; former methods were principally based on amounts calculated merely to give dimethylolurea with the urea present. It seems that resin formation is retarded by this modification ("the excess of aldehyde avoids the formation of resin in the fiber") and promotes, on the other hand, the etherification of cellulose reacting with the Zelane compound. An example cited the ratio of weight between a 40% formaldehyde solution and dimethylolurea at 100 : 30. All kinds of aldehydes may be used. Catalysts are, e.g., boric acid, lactic acid, succinic acid and so on. The addition of buffering substances in small amounts (urea or thiourea) is suggested, optionally mixed with stiffening products such as starch, methylcellulose, rubber dispersions or the like.

An example cites the impregnating of a crepe-sateen fabric with a solution containing an excess of formaldehyde, further dimethylolurea, hexamethylene tetramine, a 10% Velan solution, sodium acetate and a catalyzer as mentioned above. It refers especially to a calendering effect,

obtained by printing a thickened paste, composed as described above, drying and curing. The claims refer to water repellent, shrinkproofing and creaseproofing effects resulting from a treatment with 3 p. dimethylolurea, 10-20 p. aldehyde and 1-2 p. Velan.

References cited by the Patent Office, among others:

U. S. Pat. 2,301,352 (Heberlein—1942): preparing water repellent fabrics by impregnating with a condensate of a fatty acid halide (e.g., stearoic chloride) and hexamethylene tetramine in an inert solvent.

U. S. Pat. 2,238,839 (Watkins—1941): obtaining crease resisting finishes by impregnating the fibers first with a hardenable substance (casein), breaking down the fibers to separate the single threads, and impregnating thereupon with a resin forming compound (i.e., a ureaformaldehyde precondensate).

U. S. Pat. 2,142,623 (Calico Printer's Ass'n.—1939): finishing with a neutral ureaformaldehyde mixture, embossing and aftertreating with acid salt solutions. The embossed fabrics are permanent, the fabrics crease-resistant.

Brit. P. 508,173 (Färberei A.G., Solte—1939): waterproofing with urea-formaldehyde precondensate plus a quaternary ammonium compound of the halogen-methylethers of urethane.

Brit. P. 506,721 (Tootal-Broadhurst-Lee—1939): obtaining crease-resistant finishes by a Velan PF treatment combined with a ureaformaldehyde preparation.

Brit. P. 500,184 (Roberts & Watkins—1939): a crease-resistant treatment comprising a treatment with acidic solutions of formaldehyde.

Reference is further made to U. S. Pat. 2,347,024 (Beer—1944) suggesting the use of resin condensates plus Zelane as shrinkproofing (stabilizing) agents. This patent differs from the present invention in that no substantial excess of formaldehyde is recommended.

CELLULOSIC FIBERS, Treated With Copper Alkylolamines Plus Alkali Hydroxides G, 2, 01

U. S. Pat. 2,512,558
(Chemical Laboratories, Whitner—June 20, 1950)

The co-pending U. S. Pat. 2,446,682 (cf. REPORTER 1949, 109) states that particular effects, noticeable in improved hand and other physical modifications, can be obtained by a treatment with a copper-alkylolamine complex in aqueous solution. The present invention refers to a further improvement resulting from the addition of alkali lye to the aforementioned copper solutions. The effects obtained this way are described as follows: "adding alkalihydroxide to the alkylolamine complex decreases the adsorption of dyes while the same treatment, followed by a bleaching process has surprisingly the inverse effect, i.e., an increase of affinity." An aftertreatment with dilute hydrochloric, sulfuric or acetic acids of about 3-5% is suitable for removing residual copper salts from the fiber.

The purpose of this invention is apparently to modify cellulosic fibers at will, i.e., to decrease the affinity to dyes, by the treatment described above or to increase adsorption by means of a bleaching operation following the copper alkylolamine treatment.

DYEING MACHINE——Goods Moved with Constant Speed C, 6

U. S. Pat. 2,513,209
(Roselene—June 27, 1950)

A satisfactory coloring effect can best be obtained by passing fabrics through the dye bath at uniform speed. The normal jig dyeing process has a well-known drawback—the diameter of the leading roll increases gradually, thus causing an irregular movement of the goods. The object of the present invention is to eliminate these speed differences by driving both jig-rolls from a common power source at an equally adjustable circumferential speed, at the same time avoiding excessive braking, which places an unwanted strain on the material. This effect is brought about by providing a driven central roller (11) flanked by two auxiliary rollers (12) and (13). The fabric (see Fig. 1) is unwound from roller (31), inserted between (13) and (11) over (15) into the dye vat (21), then conducted around (20), upwards between (11) and (12). It is finally wound around the leading member (30), which can slide freely in vertical direction along standard (28). Thus the movement of the fabric remains constant in every phase of the dyeing operation, not influenced by the circumference of the fabric when wound or unwound from one roller to the other. These rollers carrying the fabric are forced by gravity to ride on rollers (12) and (13). The weight of the fabric may provide sufficient pressure to prevent slippage but this weight can also be increased, if necessary, by additional weights.

References cited by the Patent Office, among others:

U. S. Pat. 1,959,261 (1934—Butterworth): a cloth driving and tensioning apparatus for dyeing machines. A single roll is employed which causes cloth to be wound on sticks at constant speed when passing through the jig containing the dye liquid.

U. S. Pat. 1,805,122 (1931—Weinheim): a mechanism for effecting the regular movement of a strip, e.g., a fabric by friction, using several propelling devices without subjecting the material to a substantial tension. This device is recommended for treating paper strips (in telegraphic printing machines).

Reference is further made to a jig construction, described in Mettler's Ger. P. 528,983 (or Swiss P. 151,274). likewise providing a central driven roller. The fabrics are wound and unwound from two auxiliary (hollow) rollers located beneath the dyebath's surface. These are pressed against the main central roller partly by buoyancy and partly by suspending additional weights on levers connected with the rollers.

(See also the same inventors Brit. P. 392,343).

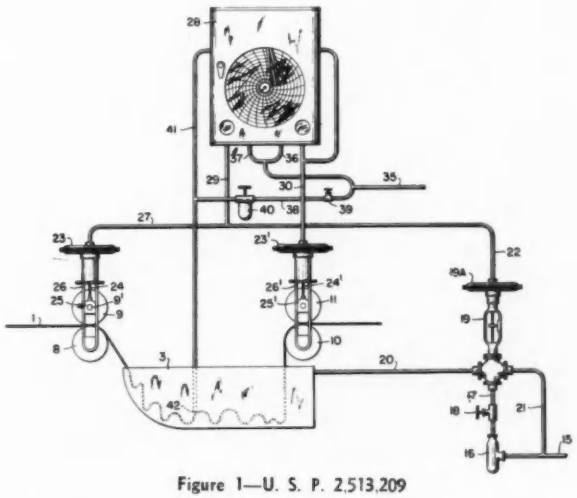

Figure 1—U. S. P. 2,513,209

TIME AND TEMPERATURE CONTROL— TWO IMPORTANT FACTORS IN DYEING

H. G. OLSON
Taylor Instrument Companies

THE days of guessing at the dye liquor temperatures, and the length of time the goods is subjected to various temperatures are over. To make it possible for a dye house to compete in today's highly competitive market, a better product must be produced at a lower cost. This means fewer re-dyes, more uniform shades, and lower operating costs from a labor and steam saving standpoint. The biggest aid to any mill in achieving this goal lies in the installation of automatic control.

The complexity and flexibility of the control system selected depends entirely on the type of dyeing and the nature of the goods being dyed. One of the most simple, yet important, types of dyeing and an application where a simple control system can be applied is the conventional dye jig shown in figure 1. Here, a rugged air-operated controller is set by the operator to the desired dyeing temperature. The output pressure from this controller is connected to the top of a diaphragm valve which permits full steam line pressure to bring the dye liquor to the pre-set temperature. The output pressure then repositions the valve so that a throttling type of control is obtained. The diaphragm valve at that point is then passing only the necessary amount of steam to maintain the set temperature. With this type of control the over-peaking and unstable control line characteristic of off-and-on type control is eliminated.

There are many types of dyeing where a controlled rate of rise is not necessary but a controlled hold time and temperature are important. By a controlled rate of rise, we mean the length of time desired to get the initial temperature of the dye vat liquor up to dyeing temperature. This would be a gradual rise made in the desired time. By "hold" time, we mean the length of time the top dyeing temperature is maintained after it has been reached. By "hold" temperature, we of course mean the top temperature at which we are controlling during the hold-time. Here an instrument is selected whereby the operator first determines what his hold temperature will be after which he sets the set pointer by the set pointer knob extending through the case to the desired hold temperature on the chart. He then turns the time dial on the upper left-hand corner of the case to the length of time he wishes to maintain this hold temperature after it has been reached. This automatically puts air to the diaphragm valve, permitting the steam valve to open fully and bring the temperature of the dye liquor up to the preset temperature as quickly as possible. At this point, the automatic timing of the hold period begins. Accurate throttling type control at the set temperature is obtained during this period. At the end of the preset time, the steam is automatically shut off and the operator informed by a signal light that the initial dyeing cycle is over. A check can be made for shade and if additional dyeing is required, it can be obtained by merely repeating the above operation after selecting the temperature and the length of time at which this temperature is to be held. Figures 2 and 3 illustrate this type of control as applied to a raw stock dye machine and a hosiery dye machine.

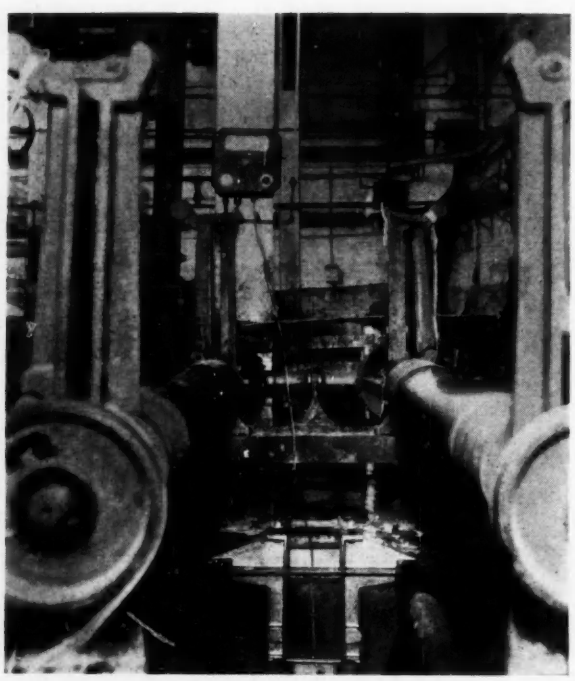

Figure 1

Some mills using a particular type of dye and dyeing the same type of goods time after time, require an instrument where the rate of rise, the hold temperature and the hold time must be controlled, but not changed. Here, there is a definite advantage to a cam-operated controller in that the precise dyeing schedule can be cut on the cam, eliminating any possibility of human error in setting these manually for each batch. This instrument is furnished with push-button starting, making it necessary for the operator to merely load his vat, start the instrument with a push-button and obtain signals any time through the operation where acids or other chemicals must be added. The entire schedule is mechanically controlled during the entire cycle with no chance of error as far as time and temperature are concerned. At the end of the dyeing cycle, that is, when the shade has been matched, the instrument is returned to "start" with a return-to-start push-button and the dye vat can be unloaded, reloaded and the exact dyeing schedule

Figure 2
Marshall Field, Spray, N. C. Plant
Raw Stock Dyeing

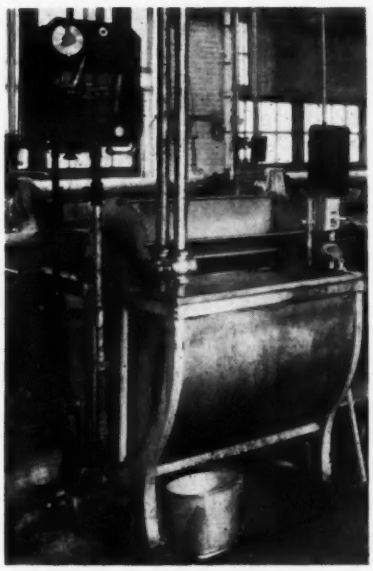

Figure 3
Hosiery Dyeing at Dexdale Hosiery Co.
Lansdale, Pa.

repeated time after time. It is also possible with an instrument of this type to have added features, giving adjustable rate of rise if desired, adjustable hold time if desired and any number of add periods easily adjustable as to time, without cutting a new cam (see figure 4).

Some mills, particularly where job dyeing is being done, require a different dyeing schedule for each different type of material being dyed. Here a completely flexible type of controller is advantageous. With this instrument (figure 5) the rate of rise is completely adjustable by setting the time dial in the upper right hand corner of the case to the specific degrees per minute required from the starting temperature to the actual dyeing temperature. The dyeing temperature is completely adjustable by means of the set pointer adjustment knob through the front of the case. By turning this clockwise or counterclockwise to any point within the range of the chart, any holding temperature can be selected. For the hold period, the time dial in the upper left hand corner of the case is preset to the length of time of the first hold period. After these three settings are made, a push button is energized, admitting steam to the dye kettle

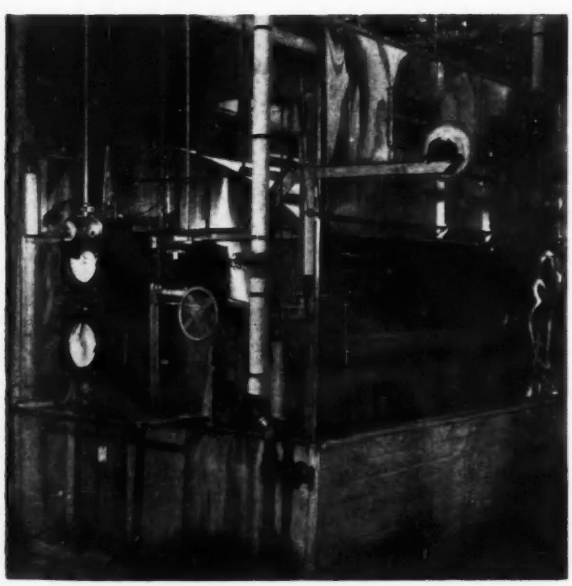

Figure 4
Flexible Time-Schedule Controller on Dye Kettle at Perry Knitting Co., Perry, N. Y.

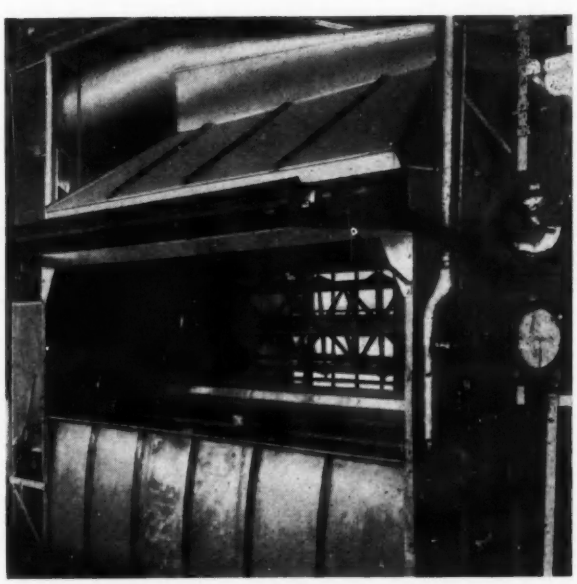

Figure 5
Rodney-Hunt Wool Piece Dye Machine at Fieldcrest Mills, Spray, N. C.

and automatically starting the instrument. At the end of the hold period, which was preset, any number of add periods can be obtained by merely resetting the timer again in the upper left hand corner of the case. A control rate of cooling, and equalizing period before the rate of rise, can be obtained with this instrument without cutting a new cam or without making the settings for the cycle, except for the initial time.

The important factor to bear in mind when selecting automatic control in conjunction with dyeing is to be sure the type of instrument you select will do the job you want it to do; buy only as much flexibility as you need, thereby eliminating as much human error as possible.

ABSTRACTS

The Coloring of Plastics

D. L. Turner, *Textile J. Australia* 25, 736-44, September, 1950.

Broadly speaking there are three distinct methods of applying color to plastics:

(a) Mass Coloration: a coloring matter is introduced at an early stage in the manufacture of the plastic article, giving even coloration throughout the mass.

(b) Surface Dyeing: application of dyestuffs in solution to the surface of the finally moulded or fabricated article.

(c) Painting, Lacquering or Printing: color is applied locally by spray or screen stencil, or by a printing roller.

Mass Coloration. This method is the most widely used, and apart from being suitable for mass production methods, it has other advantages. The color is dispersed uniformly throughout the mass, giving a more permanent result, so that scratching or degrading of the surface does not destroy the color of the article. At some stage in the production of plastics, the material is capable of being softened and shaped under the influence of heat and pressure. With the thermosetting resins, this takes place before the condensation reaction is complete, while with the thermoplastics the final product of the polymerization can readily be softened. Generally speaking it is at the softening stage that mass coloration is achieved, the color being introduced along with the fillers, accelerators, catalysts or plasticizers.

Plastics can be broadly classified as thermoplastic or thermosetting. Under thermoplastic are included cellulose acetate, cellulose nitrate, polymethyl methacrylate ("Plexiglas", "Lucite"), polythene, polystyrene, polyvinyl chloride, ethyl cellulose and nylon. The casein plastics are also related to this group. Under thermosetting are included phenolformaldehyde ("Bakelite") and urea-formaldehyde ("Beetle").

To understand why particular dyes are suitable for mass coloration, it is necessary to know the processing conditions of the plastic. The author therefore describes the manufacture of each of the various types of plastic, and lists the particular kinds of dyes which have been found most suitable for coloring it. Organic and inorganic pigments seem to be preferred, in most cases, but occasionally water-soluble or oil-soluble dyes are mentioned.

Surface Dyeing. The use of an aqueous dyebath has advantages over other solvents. Apart from higher costs, organic solvents introduce fire and toxicity hazards, and they can also injure the surface of the plastic. The author gives details for coloring each type of plastic, using in most cases the dispersed acetate dyes with the addition of a small amount of benzyl alcohol.

Printing and Lacquering. These processes are discussed briefly, and the author in closing urges the importance of using fast-to-light dyes in all coloring operations.—W.H.C.

Washable Woolens

E. C. Dreby, *Canadian Textile J.* 67, 61-4, October 27, 1950.

In recent years there has been a great deal of promotion of shrink-resistant or "washable" finishes for a great variety of wool items. During this period there have been many successful "shrink-proofing" applications but also as many or probably even more failures. However, as a result of this full scale application of a great many different types of processes, there has come about a much better understanding of washable woolens, what they are, their possibilities and their limitations. Even with all the information made available during the past ten years or so on wool shrinkage, there is still wide-spread ignorance concerning the two types of shrinkage to which wool is susceptible. One type is termed relaxation shrinkage and the other felting shrinkage.

The relaxation shrinkage of wool is simply the return to its normal state after being stretched, due to its natural elasticity. Felting shrinkage, on the other hand, is caused by the wool fibers interlocking, under favorable conditions of heat, moisture and pressure.

Discussing wet chlorination procedures, the author states that the process with which he is most familiar involves first the initial acidification of the wool to a suitable degree followed by the addition of alkali and hypochlorite in such a manner as to chlorinate from an alkaline bath in the presence of an excess of available chlorine. Since, under these conditions, chlorination is practically instantaneous and restricted in degree by the amount of acid absorbed by the wool at the time of chlorination, it is only necessary to "chlorinate" long enough to allow for complete distribution of the chemicals in the bath, usually a matter of a few minutes, and then to destroy the unused hypochlorite, which if allowed to remain would lead to yellowness, harshness, scale destruction, loss of strength, etc., by the addition of an antichlor. This process, like any other, can be handled very easily in a beaker with a hundred grams of fabric, but it is another thing to work with 500 or more pounds of fabric in a dye beck, or 500 packages in a pressure dyeing machine or even 100 pairs of socks in a paddle machine where additions are made by the bucketful or barrelful.

Some very unreasonable demands have been made of washable woolens in that to bear a label they must be shrink-resistant to all and every possible washing procedure. Very little thought seems to have been given to the garment structure in thinking of its washability. A cashmere sweater and an athletic sock may both be washable but certainly not by the same laundry procedure.

The author concludes that it is not easy to establish a precise and reproducible washing method to test the shrink-resistance of wool goods.—W.H.C.

Proceedings of the
American Association of Textile Chemists and Colorists

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ROBERT M. TRUE
General Dyestuff Corp., 1102 Terminal Sales Bldg
Portland 5, Ore.

Vice Chairman — EDWARD J. STEPHEN
Treasurer — WILLIAM C. MARSHALL

STUDENT CHAPTERS: LOWELL TEXTILE INSTITUTE, NORTH CAROLINA STATE COLLEGE, PHILADELPHIA TEXTILE INSTITUTE, NEW BEDFORD TEXTILE INSTITUTE, GEORGIA INSTITUTE OF TECHNOLOGY, CLEMSON COLLEGE, BRADFORD DURFEE TECHNICAL INSTITUTE, UTICA TECHNICAL INSTITUTE

REPORT OF ELECTION TELLERS

THE tellers appointed by the President in accordance with the Constitution, met with the Secretary at the Lowell Textile Institute on November 29, 1950, and counted ballots on the two proposed amendments to the Constitution, and on officers for the year 1951, with results as follows. Because of the close vote for the offices of Vice President, all ballots were inspected and counted twice.

For first amendment	1672
Against first amendment.....	87
For second amendment.....	1678
Against second amendment...	57
For President,	
C N Rabold.....	1806
others	1
For Vice President,	
J R Bonnar.....	1370
G O Linberg.....	1148
A W Etchells.....	1106
others	1

Raymond W Jacoby
Harry M Hartnett
Harold C Chapin
Tellers.

C Norris Rabold

J Robert Bonnar

George O Linberg

CALENDAR

COUNCIL

January 19 (Hotel Commodore, New York), April 20 (Raleigh, N. C.), June 15 (Hotel New Yorker, New York), October 18 (Hotel Statler, New York), November 16 (Hotel New Yorker, New York).

GENERAL RESEARCH COMMITTEE

January 19 (Hotel Commodore, New York), April 20 (Raleigh, N. C.), June 15 (Hotel New Yorker, New York), October 18 (Hotel Statler, New York), November 16 (Hotel New Yorker, New York).

NATIONAL CONVENTIONS

1951: October 17-18-19, Statler, New York.
1952: Nov. 6-8, Boston.
1953: September, Chicago.

HUDSON-MOHAWK SECTION

Meetings: Jan. 19 (Albany), Mar. 16 (Albany), May 11 (Albany), June 22 (Annual Outing).

MIDWEST SECTION

Meetings: February 3 (Morrison Hotel, Chicago), May 5 (Hotel Schroeder, Milwaukee), June 16 (Outing, Lake Lawn Lodge, Delavan, Wis.), September 29 (Morrison Hotel (Chicago).

NEW YORK SECTION

Meetings: Jan. 12 (Hotel New Yorker), Feb. 23 (Hotel New Yorker), March 30 (Swiss Chalet), May 4 (Swiss Chalet), June 15 (Outing).

NORTHERN NEW ENGLAND SECTION

Meeting: Jan. 26 (Hotel Commander, Cambridge, Mass.).

PACIFIC SOUTHWEST SECTION

Meeting: Jan. 26.

PHILADELPHIA SECTION

Meeting: January 19 (Kugler's Restaurant).

PUBLICATIONS COMMITTEE

January 18 (Hotel Commodore, New York).

SOUTH CENTRAL SECTION

Meetings: February 10, May 12, December 1 (all in Hotel Patten). Summer Outing: August 24-25.

SOUTHEASTERN SECTION

February 24 (Talladega, Ala.), May 5 (Atlanta, Ga.), June 15-16 (Annual Outing), September 8 (Columbus, Ga.), December 8 (La Grange, Ga.).

WESTERN NEW ENGLAND SECTION

Meetings: Jan. 26 (Shelton), March 16 (Danbury), May 4, June 22 (Outing).

OTHER EVENTS

AMERICAN SOCIETY FOR TESTING MATERIALS

Spring Meeting and Committee Week, March 5-9, Cincinnati, Ohio.

Annual Meeting, June 18-22, Atlantic City, N. J.

Spring Meeting and Committee Week, March 3-7, Cleveland, Ohio.

Annual Meeting, June 23-27, 1952, New York, N. Y. (The biennial Apparatus and Photographic Exhibits will be held in conjunction with this meeting).

NATIONAL ASSOCIATION OF TEXTILE MACHINERY MANUFACTURERS

Exhibit of American Textile Machinery, April 26-May 1, 1954, Atlantic City Exhibition Hall, Atlantic City, N. J.

TEXTILE RESEARCH INSTITUTE

Annual Meeting, Nov. 8-9.

Ruth Denio Wins NNE Award

RUTH DENIO of Lowell, Mass was named the recipient of the Northern New England Section's annual award "to a worthy junior at the Lowell Textile Institute" at the December 1st meeting of the Section at the Hotel Vendome, Boston. The $250 award, given over the past several years, is made on the basis of scholastic standing and participation in extra-curricular activities. A chosen group of sectional officers concurs with LTI officials in selecting the winner.

The featured speaker of the meeting was George Schuler, Director of the Technical Laboratories, E I du Pont de Nemours & Co, Inc. As an added feature Edward Chapin of W C Durfee & Co, local corporate membership chairman, read some statistics on corporate memberships.

Ruth Denio is shown receiving the Northern New England Section's Annual Award from Section Chairman Frank J. O'Neil.

CONVENTION QUESTIONNAIRE

QUESTIONNAIRE

A. Attendance

1. Did you attend the Augusta, Ga. Convention in 1948? Yes ( ) No ( )
2. Did you attend the Atlantic City Convention in 1949? Yes ( ) No ( )
3. Do you plan to go to Portsmouth, N. H. this fall? Yes ( ) No ( )

B. Reasons

If you failed to go to any of the above, was it because

1. Of the time and distance involved? Yes ( ) No ( )
2. The program lacked attractiveness? Yes ( ) No ( )
3. You personally pay your own Convention expenses? Yes ( ) No ( )
4. Your employer failed to appreciate the value of these meetings? Yes ( ) No ( )

C. Location

1. Would you prefer that the locale of the annual convention be rotated from Boston to New York to Atlantic City, with occasional visits to Chicago, or possibly Palm Beach or California? Yes ( ) No ( )
2. Would you rather that the Convention be confined to the first three cities mentioned under number 1? Yes ( ) No ( )
3. Should we settle on one centrally-located convention city, —probably Atlantic City? Yes ( ) No ( )

D. Program

1. In general, do you like the present program of the annual meeting? Yes ( ) No ( )
2. Is one banquet enough? Yes ( ) No ( )
3. Do you think the Convention Committee should try to discourage the leasing of suites to companies for use as private bars? Yes ( ) No ( )
4. The 1951 Convention in New York City is scheduled for Wednesday, Thursday and Friday. Do you prefer this to the usual Thursday, Friday and Saturday schedule? Yes ( ) No ( )

E. Information for your local section officers:

1. If you do not participate in your local section's activities, would you be interested in holding office? Yes ( ) No ( )
2. Can you cooperate on any of our research programs? If so in what subjects are you interested? Yes ( ) No ( )

LAST summer the National Convention Committee proposed, and the Council approved, spending $500.00 on a convention questionnaire which was mailed to all our members. The primary object of this was to get factual data and not merely opinions, or various questions in connection with our annual meetings. We wanted to know, for instance, what you liked about the conventions, why you attended them, and where you wanted future conventions to be held. As only one man in every four or five goes to these meetings, we were particularly concerned about the reason why so many of you failed to attend. Then while doing this job, our president, C. Norris Rabold, suggested it would be a good chance to get the names of any members—particularly new members—who might be interested in working for their local sections, either in research or in the section's other activities.

It took some time to get all these questions in shape and in such a form that they could be readily answered by checking "yes" or "no". The questions were printed by the *American Dyestuff Reporter* and mailed out September 1, 1950. A copy of the questionnaire is reproduced on this page. A few of them are still coming back in mid-November, and it has taken considerably more time to classify the answers than to get out the questionnaire in the first place. Ballots have been classified by local section and

TABLE I
COMPLETE RETURNS OF ALL BALLOTS

Line	SECTION:	North. N. E.		Rhode Island		New York		Phila-delphia		Pied-mont		South Eastern		South Central		Mid-West		West. N. E.		Pacific Coast		Hudson Mohawk		Canada		Totals	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1.	A. Attendance																										
2.	1. Augusta, Ga.—Yes	33	14	36	16	106	20	97	24	138	52	55	61	20	32	26	17	3	8	1	2	7	11	0	0	522	25
3.	2. Atlantic City, N. J. —Yes	73	31	94	42	240	46	246	62	81	31	17	19	11	18	36	24	9	24	3	5	19	29	10	46	839	40
4.	3. Portsmouth, N. H.—Yes	181	48	157	70	227	44	117	30	61	23	13	15	9	15	28	19	18	49	1	2	27	42	10	46	849	40
5.	B. Reason for Nonattendance																										
6.	1. Time and Distance—Yes	145	62	136	61	269	52	206	52	165	63	65	72	35	56	85	57	23	62	49	83	39	60	14	64	1231	58
7.	2. Unattractive Program—Yes	12	5	8	4	32	6	28	7	8	3	4	5	7	11	14	9	5	14	1	2	4	6	2	9	125	6
8.	3. Personally Paid Expenses—Yes	66	28	59	26	130	25	94	24	61	23	23	25	10	16	34	23	11	30	17	29	16	25	7	32	528	25
9.	4. Employer Refused—Yes	20	9	24	11	56	11	54	14	38	14	14	15	8	13	29	19	5	14	9	15	16	25	2	9	275	13
10.	C. Location Preferred																										
11.	1. Rotate Everywhere—Yes	98	42	73	33	164	31	113	29	97	37	40	41	22	36	84	56	9	24	39	66	23	36	8	36	770	36
12.	2. Rotate Boston, N. Y., A. C.—Yes	129	55	125	56	218	42	139	35	64	24	16	18	11	18	26	17	22	60	6	10	37	57	12	55	905	38
13.	3. Atlantic City Always—Yes	45	19	72	32	318	61	210	53	116	44	18	20	21	34	33	22	16	43	7	12	17	26	5	23	878	41
14.	—*No	99	43	70	31	122	23	87	22	73	28	40	41	22	36	62	42	9	24	25	43	25	39	8	36	642	30
15.	D. Program																										
16.	1. Present O.K.—Yes	187	80	199	89	442	85	340	86	230	87	74	82	47	76	114	76	27	73	46	78	55	85	19	86	1780	84
17.	2. Only One Banquet—Yes	204	88	203	91	434	83	346	87	219	83	75	84	50	81	125	84	33	89	35	60	55	85	19	86	1798	85
18.	3. Discourage Private Bars—Yes	95	41	106	47	211	40	151	38	112	43	39	48	18	29	58	39	17	46	20	34	24	37	16	27	857	40
	—*No	105	45	99	44	199	38	188	47	108	41	34	42	30	48	67	45	10	27	20	34	28	43	13	59	901	43
20.	4. Meeting Wed., Thurs., Fri.—Yes	120	52	106	47	332	64	247	62	132	50	53	59	33	53	82	55	20	54	27	46	45	70	16	73	1213	57
21.	—*No	72	31	107	48	149	29	115	29	102	39	20	22	20	32	37	25	16	43	12	20	17	26	4	18	671	32
22.	E. Local Section Activities																										
23.	1. Interested Holding Office—Yes	43	18	53	24	108	21	53	13	46	17	9	10	8	13	14	9	2	5	8	14	10	16	1	5	355	17
24.	2. Interested Cooperative Research—Yes	50	22	54	24	141	27	82	21	11	4	18	20	19	31	53	36	6	16	3	5	17	26	4	18	458	22
25.	Total Number Voting	233		224		524		397		264		90		62		149		37		59		65		22		2126	
26.	Total Listed Senior Membership—5/1/50	443		483		1081		824		525		193		122		292		115		100		134				4563	
27.	% Returning Questionnaire	52%		46%		48%		48%		50%		47%		51%		51%		32%		59%		48%				47%	

* Negative Vote—All Others Are "Yes"

the results have been tabulated in two tables. Table I gives the results of the 2126 ballots returned, and the percentage of the total ballots returned is figured for each question for each section, as well as for the total received.

Table II is confined to three questions on which there might be a distinct difference of opinion depending upon whether you were a millman or a supplier. The votes, therefore, are classified under these two groups. As it was physically impossible to go through the entire 2000 ballots for this purpose, Table II has been confined to those men who attended at least two conventions, with the thought that their opinion should carry more weight than that of those who never attend. In order to get a representative opinion across the whole country, a sample representing roughly 4% of the total membership from each section was taken for this work. Within these two limits roughly one-third of the ballots which were returned were classified under Table II.

The first interesting result from the questionnaire is the large number of ballots returned. Nearly one-half of our senior members took the trouble to check the ballots and mail them back. Only one section, Western New England, seemed to fall down in this respect (see line 27, Table I). This high return indicates a widespread interest in the subject and nearly 100 men wrote in suggestions or asked questions which we are still trying to acknowledge. Furthermore, we got an excellent response from those who have never attended a convention, but wanted to register their opinions about it anyhow.

Turning now to the results, the first question under "A" had to do with attendance at the last two conventions and the expected attendance at Portsmouth, N. H. On the basis of the ballots coming back by the end of September, we knew that the Portsmouth meeting would nearly equal the 1949 record at Atlantic City (lines 2 and 3, Table I). Data on attendance is a great help to any convention chairman.

The questions under "B" had to do with the reasons for not attending, and as one might anticipate, the time and distance required to go to these meetings is the principal reason why many cannot make them (line 6, Table I). We were surprised a bit to find that one man in every four pays his own way so that the matter of expense is also a factor in nonattendance. A great many men felt that their employer (line 9, Table I) did not

appreciate the value of these meetings. Probably a partial cure for nonattendance would be to rotate the conventions from one city to another around the country so that at least one of them will be fairly close to everyone every three or four years.

On the question of location under "C", 41% of those voting favored going to Atlantic City permanently. Naturally this idea was particularly popular in the New York and Philadelphia sections. As those two sections constitute 40% of our membership, this explains the high percentage in favor of this choice. A great many of the younger men cannot afford to spend three days and nights at a convention, but they can drive over for the day and possibly come back again the second day, if the convention is near enough his home to do so. The ballots also indicated, however, that 30% of our members do not care for Atlantic City at all. While the questions as written permit some duplication, it is safe to say that if 40% of those who voted want to go to Atlantic City year after year, it is certain that 60% of those voting do not. Furthermore, in view of the fact that time and distance and expense keep many men from attending, it would seem only fair to rotate the convention city so that all would have an equal chance of going.

When this question of location was asked solely of the men who attend conventions (Table II, lines 7 and 8) the ratio of those who want to rotate over those who prefer to stay in Atlantic City is more than two to one, and it does not seem to matter on this question whether you are a mill man or a supplier.

The questions as to your likes and dislikes under Section "D" showed an almost unanimous response in favor of our present method of running the conventions. Moreover, between 80% and 90% of those replying would like to limit the number of banquets to one. This single banquet idea will be tried out in New York City in 1951. Another innovation is the suggestion of moving the convention dates ahead one day so that it would start on Wednesday and end on Friday rather than Saturday night. This seemed to get the popular vote by about two to one, but in Table II it will be noted that the suppliers are really the ones who go for this change, the mill men being about equally divided pro and con.

Question D-3, lines 18 and 19, Table I, seemed to cause the most discussion and has to do with the use of hotel rooms as private bars. It should be emphasized again that the question of prohibiting liquor is *not* being considered here at all, but the question has to do with the possibility of curtailing these activities late at night in hotel rooms where they might disturb those trying to sleep. The vote was pretty even, 40% for discouraging this practice and 43% for continuing it. Apparently this viewpoint is strictly an individual matter, at least just about the same division is shown between the mill men and suppliers (Table II, lines 10 and 11). In view of the closeness of the balloting nothing further will be done about this matter and it is considered closed.

Another unexpected dividend which the questionnaire brought forth were the names of 300 to 400 men, many of them new members, who would like to work more actively for the AATCC either in cooperative research work or in organizing the local section's activities. All these names have been carefully separated and sent to Dr. Harold Chapin, our secretary at Lowell, who will in turn make lists of of them and forward these lists to the sectional chairman so that he can get in touch with them whenever he needs them. Nearly one man in every five voting offered his services in some capacity and it must be a great comfort to our officers to know the names of so many volunteers for the actual work which keeps our society alive and strong.

In summarizing the voting on this questionnaire, the following conclusions seem evident. Those of our members who do not attend conventions are prevented from doing so by the expense and time it takes to go and many of these men pay their own way. Rotating conventions will give the men in Alabama a chance to attend as well as those in New Hampshire, at least once in every few years. Rotating the conventions is favored not only by a majority of those voting but also by a majority of those who actually go to the conventions.

The general program of our conventions is well liked, but innovations of having only one banquet and of moving the convention ahead one day seem to be acceptable.

The Committee wishes to thank all those who cooperated with us by sending in their ballots, especially those who offered to cooperate in their local section's activities. The many messages, questions and suggestions which came in as a result of this questionnaire are also highly appreciated.

National Convention Committee
Kenneth H. Barnard, *Chairman*
Samuel L. Hayes
George H. Wood
George L. Linberg
Charles W. Dorn
Walter F. Fancourt, III

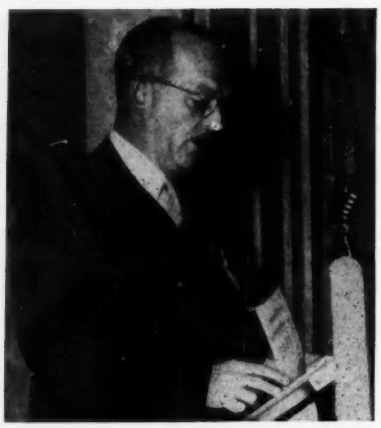
TABLE II
A SAMPLE LISTING FROM THOSE ATTENDING AT LEAST TWO CONVENTIONS

SECTION:	*North. and West. New England*		*Rhode Island*		*New York*		*Philadelphia*		*Piedmont*		*Southeastern*		*South Central*		*Mid-West*		*Pacific*		*Hud on-Mohawk*		*Totals*		
Line	Mill-men	Sup-pliers	Mill-men	Sup-pliers	Mill-men	Sup-pliers	Mill-men	Sup-pliers	Mill-men	Sup-pliers	Mill-men	Sup-pliers	Mill-men	Sup-pliers	Mill-men	Sup-pliers	Mill-men	Sup-pliers	Mill-men	Sup-pliers	Mill-men	Sup-pliers	*Both Totals*
1. Ballots from:																							
2. Millmen	10		8		11		6		7		1		2		2				3		50		
3. Suppliers	10		12		23		20		14		6		3		9				2		99		
4. Govt., Educ., Unclassified	4		0		1		3		0		1		0		1				0		10		
5. Total Ballots Used	24		20		35		29		21		8		5		12		0		5		159		
6. C. Location of Convention																							
7. Favor Rotation	8	10	7	8	6	14	3	12	5	6	1	4	0	3	2	8			2	2	34	67	101
8. Favor Atlantic City	2	0	1	4	5	9	3	7	2	8	0	2	2	0	0	1			1	0	16	31	47
9. D-3. Private Bars																							
10. Favor Discouraging	3	7	4	6	8	11	0	9	2	6	?	3	0	0	0	5			1	1	18	48	66
11. Object to Discouraging	6	3	4	6	3	11	4	11	3	6		3	2	3	1	4			1	0	24	47	71
12. D-4. Time of Week																							
13. Wed., Thurs., Fri.	5	10	3	11	7	15	3	13	1	11	1	6	2	2	0	6			2	2	24	76	100
14. Thurs., Fri., Sat.	4	0	5	1	4	8	3	3	5	3	0	0	0	1	1	3			1	0	23	19	42

Intersectional Contest
Second Prize Winner

THE CONTINUOUS DYEING OF NYLON FABRICS*

RHODE ISLAND SECTION



Dr. W. George Parks

Preliminary tests indicate that it is possible to dye nylon fabrics by the use of acid colors by padding the dissolved dyestuff and steaming in conventional vat-dyeing equipment. The chemistry and the physical nature of the phenomena are discussed.

Spectrophotometric data are tabulated, showing the color value, wash fastness, influence of variation in length of steaming, influence of acids or assistants, and influence of heat treatments. Common dyeing problems of migration, preferential sorption, warpiness and barré effects are discussed from data obtained during plant dyeings.

Committee

EDWARD W. LAWRENCE, *Chairman*
DR. W. GEORGE PARKS, *Speaker*
Edward J. Allard
Edward H. Gamble
Raymond B. Taylorson
William H. Cady
John Roarke
Arthur F. McLean
J. Wm. Timperley
Robert P. Wood
Peter J. Ariente
Raymond W. Jacoby
George H. Wood
William J. Jutras
Arthur C. Merrill
Ernest J. Chornyei
James A. Davies

INTRODUCTION

EVER since nylon became available in commercial quantities, the dyeing of nylon fabrics has been the subject of many investigations in the laboratory and in commercial dyeing plants. It was found that nylon, even though having chemically reactive groups similar to those of the wool fiber, has a low dye affinity, and early attempts to dye nylon by wool-dyeing methods were unsatisfactory. In addition to its low affinity, there appeared to be a considerable variation in the dye affinity of different yarns making up the fabrics. Dye streaks, warpiness and barré effects were prevalent in many dyeings as a result of this variation. However, it was observed that excellent fastness could be obtained by the use of acid, premetallized and chrome dyes *(1)*.

Dispersed acetate dyes were found to be absorbed by nylon without showing many of the defects commonly observed where acid or chrome dyes are used. These dyes were absorbed by the nylon fibers in a manner similar to the absorption by cellulose acetate fibers, or by "forming a solution" within the fiber. Acetate dyes do not react chemically with nylon, and it is easily understood why a slight variation in the chemical nature of nylon does not affect the absorption of these dyes. In addition, since acetate dyes are not so firmly held as dyes that react chemically with the nylon, a variation in absorption of the dyes because of physical effects is not apparent because these dyes boil off and dye back on, giving a level shade when dye equilibrium is reached.

Fidell *(2)*, in describing the manufacture of nylon and its physical properties, stated that nylon for textiles is a round, smooth, thermoplastic fiber of marked uniformity of diameter and of exceptional tensile strength and elasticity. It is made by extrusion of a molten mass of the superpolymer of hexamethylene diamine and adipic acid with a molecular weight of about 12,000 *(3)*. To obtain the optimum physical property and the required diameter size the extruded nylon is cold-drawn or stretched to four hundred or five hundred per cent of its original length. The degree to which it is drawn or stretched has definite effects both on the physical properties of the fiber, one of which is an increase in the tensile strength, and on the receptivity to dye, which is decreased as the length is increased.

Considerable research was devoted to the application of acid dyes during the last war, and a nylon-dyeing task committee was formed under the leadership of Arnold L. Lippert, Chief, Dye and Finishing Branch, of the War Production Board. Many members of this committee worked on this dyeing problem at that time. The methods used, as reported by P. L. Meunier and A. K. Saville *(4)*, consisted of padding acid and chrome dyes in an alkaline solution, drying and steaming for 10 to 20 minutes in vat-steaming equipment, where 75 per cent of the dye was fixed. Treatment on the jig allowed the remaining dye to be fixed. The method had many disadvantages and did not eliminate warpiness and barré effects, since the padded material had to be finished on jigs. In addition to this, the padding and drying problem was difficult to overcome because of the tendency of the dyes to migrate in drying. The steaming in vat-steaming equipment was at best an extremely difficult operation because of the possibility of water drops, creases and loose threads on the steam rollers causing marks that could not be removed, since, in the initial stages of the steaming process, the color is not fixed, and all the effects enumerated would cause dye migration. However, it should be stated that excellent fastness was obtained by this method.

* Presented at Twenty-ninth Annual Convention in Portsmouth, N. H., on Sept. 29, 1950.

An improvement in this process was reported in a du Pont Technical Laboratory Bulletin *(5)*, where thiourea, thiodiglycol, gum and ammonium sulfate are added to the padding liquor. After being padded, the material is dried and steamed 10 to 15 minutes. The steaming and padding problems enumerated above still exist, but the elimination of the finishing off on the jigs is a definite improvement.

Another method of dyeing with acid and chrome colors by padding, drying and heat setting for 1 minute at 400°F. was reported by Lawrence *(6)*. Thirty per cent glycerine was added to the padding mixture, and, after the goods had been heat-set, good dye fixation and excellent wash fastness were obtained. It was recognized that there were many limitations to this method and that considerable work would have to be done to make it practicable.

A similar method of dyeing nylon, known as the Thermosol process, was reported in a du Pont Technical Bulletin *(7)*. In this method acid colors are padded and dried, with the addition of ammonium sulfate and other materials, and then subjected to heat at approximately 400 to 450°F. for fractions of a minute. This method is interesting, but it has not been developed to the point where it can be used as a universal method of dyeing nylon. The problems of padding, dye migration, shrinkage during the heat treatment and other factors make the operation sufficiently difficult to require qualified technical personnel.

Acid and many direct dyes have been shown by Peters *(8)* to form salt linkages between the dye acids and the end amino groups of the nylon polymer, as in the following simple equation:

$$HOOC \cdot Ny \cdot NH^{+}_{3} + D^{-} \leftrightharpoons HOOC \cdot Ny \cdot NH_{3}D$$

(Ny = the nylon residue)
(D = dye acid)

Peters showed that the amino groups in nylon can be titrated and that 1 gram of nylon yarn reacts with 0.053 milliequivalents of hydrochloric acid. He also showed that the amount of dye acid absorbed by nylon during dyeing to form the salt linkages is 0.05 milliequivalents of dye per gram of fiber. Under strong acid conditions acid colors are absorbed in much greater quantities, but desorption studies showed that these larger quantities of acid dyes are not held so strongly and can be removed readily from the fiber. A similar study with wool fibers indicated that one gram of wool fiber absorbs 0.80 milliequivalents of dye, and therefore wool has sixteen times greater dye affinity than nylon.

At a recent meeting of the Textile Institute Conference, A. R. Munden presented a paper on "Measurement of Dyeing Properties and Correlation with Orientation in Nylon Yarn" *(9)*. He stated that there are three structural properties in common nylon that are known to influence the dyeing characteristics of nylon yarn under given dyebath conditions as follows:

1. Amine end-group content. An increase in amine end-group content increases the dyeing rate of anionic and dispersed dyes and the anionic-dye uptake.
2. Degree of order or crystallinity. An increase in degree of order decreases the dyeing rate.
3. Degree of orientation. An increase in orientation decreases the dyeing rate. Because of the fewer sites the dyeing rate depends critically on the diffusion process, which in turn is a function of the molecular orientation and order. High orientation and a high state of order hinder the dyestuff molecule in its progress to a suitable site. Thus, any minor physical differences in structure of the nylon have a large effect on the dyeing properties. The equilibrium uptake of the yarn is not necessarily altered by changes in physical structure.

When these factors are considered, it can be understood why certain yarns have greater dye affinity than others, and the most reactive dye acids in a dye mixture occupy the reactive sites and block off the dye absorption of the less reactive dye acids, so that dyeing with a mixture of acid-type dyes very often does not give the expected compound shade. Also, dyes with greater diffusion rates dye more rapidly.

In our investigation we have attempted to overcome the variation in dye affinity of the yarn by a padding procedure and thus to obtain a dyed nylon fabric that will have satisfactory wash and light fastness without the drawbacks heretofore encountered in commercial dyeings. It is obvious that in dyeing by the use of jig or beck equipment more dye is absorbed by the most receptive yarns. We have found that, when nylon fabric is padded under conditions where relatively no dyeing takes place in the padder, we can fix many dyes by steaming a few seconds, and that dyeing defects are not apparent. We have dyed by padding with completely dissolved acid and other dyestuffs, then steaming in conventional padding and steaming equipment, and washing. After-treatments in some cases were used to improve the wash fastness.

The results of a short steaming are amazing, as were shown by the swatches originally attached to this paper. Swatches padded with 1 per cent Brilliant Croceine M (C.I. 252) and 2 per cent of formic acid, and with 1 per cent of Alizarine Cyanine Green (C.I. 1078) and with formic acid, respectively, were barely colored. Steaming for 15 seconds brought out deep colors in both instances.

FASTNESS REQUIREMENTS

Since nylon has great strength and garments made from nylon fabrics are very durable, wash fastness was considered of considerable importance. It was decided that, if a method of dyeing was going to have much practical value, the dyeings should withstand a No. 3 AATCC wash test for manufactured organic fibers. Therefore, all experimental work in the laboratory and in plant runs has been tested by this No. 3 wash test. For the purpose of determining color yields, dyeing rates and other problems connected with the dyeing, tests have been conducted without a preliminary washing, which might be the commercial practice. Pot dyeings and continuous dyeings were only rinsed with cold water after they had been made, and then they were tested. Therefore, in much of the experimental data accumulated, a considerable wash-down with test No. 3 is reported. Dyes have been selected that do not show an appreciable progressive wash-down when subjected to this test, and that show good light fastness, wherever possible, with no appreciable break below 20 hours in a standard Fade-Ometer.

Fade-Ometer exposure tests made in many different laboratories on the same material showed considerable variation, even though calibration papers showed very little difference. Sunlight exposure tests run on the same material against wool standards caused considerably less fading than Fade-Ometer tests. This generally is in accord with the results of tests carried out by the various dyestuff companies. No attempt at an explanation of this phenomenon is given here. Many theories have been evolved to explain this difference, but no attempt has been made in this investigation to check them by experimental work as this is beyond the scope of this paper. Other fastness tests have not been carried out since it was felt that, if the wash and light fastness correspond to the published figures on material dyed by our method, other fastness properties for each individual dye would correspond closely to the published data. Crock tests have been carried out, but in all cases there was no crocking. Therefore, these tests are not included.

GENERAL METHOD OF PROCEDURE

Many dyeing plants in Rhode Island are equipped with continuous ranges for vat dyeing, employing padding, steaming and washing equipment. The speed of these dyeing ranges varies considerably, but the length of time of the cloth travel

through the steamer in many cases is from 12 to 15 seconds. One plant is equipped with a variable-speed range, where the length of time in the steamer can be varied from 15 seconds to 1.5 minutes. In general, for practical operation, it was believed that 15 seconds' steaming time would be the most practicable length of time that padded cloth could be steamed on equipment available. The laboratory trials were therefore run on this basis, and a general procedure was established to pad and steam for 15 seconds, to rinse with cold water and to measure the amount of dye absorbed; also, the fastness properties of the dyed material and the general appearance were observed. Early results indicated that an aftertreatment by heat-setting and/or dry steaming would improve the wash fastness. To study the dyeing characteristics of the various dyes and to make a proper selection of dyes to be used in plant dyeings, the length of time for steaming was varied in the laboratory from 1 second to 15 minutes. The effect of steaming in the dyeing of nylon was immediately apparent when padded with 0.1 per cent Alizarine Cyanine Green at 175°F. and (A) washed immediately, (B) steamed 1 second, (C) steamed 15 seconds and (D) steamed 30 seconds, all with the regular pad steam procedure. Sample A showed no dyeing, whereas sample B showed considerable dyeing. Samples C and D were dyed slightly heavier than B. These results indicated that a simple padding and steaming might result in excellent dyeings in light shades.

Standard nylon constructions were used. There was considerable variation in results because of differences in cloth construction and degree of pigmentation. No bright nylon was used. However, as each series of tests was completed with the same material, the results obtained are comparative. The preparation of the cloth for laboratory and plant trials was carried out in one plant, except as stated. The general procedure of cloth preparation followed was to boil off on jigs with one-half lb. of soap, 8 oz. of Igepon T and 2 lb. of soda ash for 5 ends at 160°F., to wash for 3 ends in hot water, to dry and to cylinder-set at 325°F.

TABLE I.
POT DYEING

Cloth construction: 120 x 86
Weight: 7.14 yards per pound
Width: 47¾" in grey
43½" finished

Color Name	C.I.	Per Cent	General Appearance	Wash Fastness AATCC No. 3	Staining	Light Fastness: Fade-Ometer 10-Hr.	20-Hr.	30-Hr.	40-Hr.	Sunlight 24-Hr.	48-Hr.
Polar Orange R	Pr. 152	0.5	S	S	None						
Polar Orange R	Pr. 152	.1	S	S	None	B	P	P	D		
Polar Yellow 2G	642	.5	S	S	None						
Polar Yellow 2G	642	.1	S	S	None	S	SB	F	F		
Alizarine Irisol R	1073	.5	S	F	None	B	P	P	D		
Alizarine Irisol R	1073	.1	S	F	None						
Brilliant Croceine M	252	.5	S	S	None						
Brilliant Croceine M	252	.1	U	S	None						
Sulphon Cyanine 5R	289	.5	U	S	None						
Sulphon Cyanine 5R	289	.1	U	F	None	B	P	P	P		
Chlorantine Fast Yellow 5GLL		.5	S	S	C-R						
Chlorantine Fast Yellow 5GLL		.1	U	F	C-R	B	D	D	D		
Kiton Fast Red 4BLN		.5	U	F	None						
Kiton Fast Red 4BLN		.1	U	P	None	B	F	P	P		
Fast Acid Brown RG		.5	S	S	None		B		P	B	F
Fast Acid Brown RG		.1	S	S	None		B		P	B	P
Alizarine Supra Blue A	Pr. 12	.5	S	F	W		B		P	B	F
Alizarine Supra Blue A	Pr. 12	.1	S	F	None		B		P	B	F
Anthraquinone Violet	1080	.5	U	F	None		S		B	S	B
Anthraquinone Violet	1080	.1	U	F	None		S		SB	S	SB
Neolan Pink B	Pr. 389	.5	U	S	None		B		P	B	F
Neolan Pink B	Pr. 389	.1	U	S	Slight RC-		B		P	B	F
Alizarol Orange 3R		.5	S	S	None		B		P	B	P
Alizarol Orange 3R		.1	S	S	None		B		P	B	P
Polar Red G	430	.5	S	S	None		B		P	B	P
Polar Red G	430	.1	S	S	None		B		D	B	P
Polar Red B	430	.5	S	S	None		B		P	B	P
Polar Red B	430	.1	U	S	None		P		D	P	D
Alizarine Rubinol R	1091	.5	S	S	None		B		P	B	P
Alizarine Rubinol R	1091	.1	S	S	None		B		D	B	F
Pontachrome Fast Gray L		.5	S	S	None		B		P	B	F
Pontachrome Fast Gray L		.1	S	S	None		SB		P	SB	F
Chromolan Grey G		.5	S	S	None		B		P	B	P
Chromolan Grey G		.1	S	S	None		B		P	B	P
Neolan Bordeaux R	Pr. 145	.5	U	S	None		B		F	SB	B
Neolan Bordeaux R	Pr. 145	.1	U	S	None		B		P	B	P
Fast Acid Yellow GS		.5	S	S	None		P		D	B	P
Fast Acid Yellow GS		.1	S	S	None		Reddes D		D	D	D
Chrysophenine	365	.5	S	S	C-R		S		S	S	S
Chrysophenine	365	.1	S	S	Slight C-R		S		B	S	SB
Diamine Scarlet B	382	.5	S	S	C-R		B		P	B	F
Diamine Scarlet B	382	.1	U	S	C		D		D	D	D
Metanil Yellow	138	.5	S	F	W-Silk		S		SB	S	SB
Metanil Yellow	138	.1	S	F	W-Silk		B		P	SB	B
Alizarine Sky Blue B	1088	.5	S	F	None		B		P	SB	B
Alizarine Sky Blue B	1088	.1	S	F	None		B		P	S	SB
Pontamine Fast Orange 2GL		.5	S	S	C-R		B		P	SB	B
Pontamine Fast Orange 2GL		.1	S	F	C-R		B		P	B	F
*Neutracyl Blue G		2		5-4W					6		
*Neitracyl Yellow N		2		4W					8		
*Neutracyl Yellow 3RD		2		4W					8		
*Neutracyl Black N		10		5-4W					8		

*Pot dyeings were not made. Fastness ratings reported by the manufacturers (12). Where data are not given, tests were not completed.

S = Satisfactory
F = Fair
P = Poor
U = Uneven
C = Cotton
R = Rayon
W = Wool
Silk = Silk
D = Destroyed
B = Break
SB = Slight Break

DYES SELECTED FOR FASTNESS PROPERTIES

The Committee examined the fastness data as published by the various dye manufacturers *(2, 10, 11)* and, considering the minimum fastness requirements believed practical, selected many products for further testing. These dyes are shown in Table I.

Pot dyeings were made to compare relative yields, general appearance and the fastness properties with those obtained by a continuous dyeing operation. The general procedure followed was to make 0.1 per cent and 0.5 per cent dyeings based on the weight of the cloth. Five per cent of ammonium acetate and 2 per cent of ammonia water were added to the dyebath at the start, and the dye was exhausted from the bath with 5 per cent of formic acid, 85 per cent.

The fastness data listed have been evaluated according to AATCC methods and are based on pot dyeings (nylon 70/34, type 200, pigmented both warp and filling).

EFFECT OF ASSISTANTS IN DYEING NYLON

IN THE DYE SOLUTION ——— Part of the early work in this study was based upon data secured in a survey of dyes satisfactory for printing on nylon. The print pastes contained 5 per cent of urea and 2 per cent of formic acid, 85 per cent,

in addition to dye, water and thickener. The qualities held necessary to make a color suitable for printing were the following:

1. Satisfactory light fastness.
2. Satisfactory wash fastness.
3. Satisfactory build-up in depth of shade as the concentration of dye was increased.
4. Print pastes that would not lose strength upon standing overnight.

Machine prints were made in the usual manner, dried, steamed for various times, and rinsed in running cold water. The operation was repeated the next day with the same print paste. Samples of each print were steamed 8 minutes, 16 minutes and 1 hour, respectively. The depths of shades of prints with various dye concentrations and steaming times were compared. Forty-hour Fade-Ometer tests were made, as well as AATCC No. 2 wash tests for manufactured fibers. From these tests and observations the following eight colors were selected as most satisfactory for producing a range of shades:

Neolan Orange R (Pr. 146)
Chlorantine Fast Yellow 5GLL
Brilliant Crocein M
Kiton Fast Red 4BLN
Sulphon Cyanine 5R
Alizarine Cyanine Green
Alizarine Fast Light Blue C
Neolan Black J

The next step was to determine how these dyes would react when cloth was padded through a solution containing the same amounts of dye, urea and formic acid and then steamed immediately while wet. Fifteen seconds was selected as the steaming time as this was considered to be the average in pad-steam ranges. After being steamed the samples were rinsed in running cold water and dried. The results obtained by this treatment were only fair. A number of other assistants were added to the solutions of dyes, and the pad-steam process repeated. The dye solutions were of the following concentrations: 0.5 per cent, 1 per cent, 2 per cent and 3 per cent.

The various assistants tried, the amounts thereof, and the results obtained were as follows:

2% Formic acid—Fair to very satisfactory; in some instances, better than with 2% formic acid and 5% urea.
3% Ammonium sulfocyanide—Very poor.
2% Formic acid, 10% urea—Fair; practically no improvement over 2% formic acid and 5% urea.
2% Formic acid, 15% urea—Fair; practically no improvement over 2% formic acid and 5% urea.
10% Kromfax solvent—Very poor.
10% Diethylethanolamine—Practically no color remained on goods after rinsing.
2% Ammonium sulfate—Fair to very satisfactory.
30% Hexylene glycol—Very poor to fair.
20% Kromfax solvent—Poor to fair; only slight improvement over 10% Gromfax solvent.
10% Formic acid—Excellent.
1% Salicylic acid—Poor to satisfactory.
2% Ammonium salicylate—Very poor.
2% Tannic acid—Poor to fair.
1% Cinnamic acid—Very poor to fair.

The results with 10 per cent of formic acid, 85 per cent, in the dye solution were outstanding. However, it was believed that the use of such a high concentration would not be satisfactory plant practice for several reasons.

Ammonium sulfate gave satisfactory results, but it was considered that the presence of a mineral acid from the hydrolysis of this salt might have deleterious effects.

As 2 per cent of formic acid, 85 per cent, gave satisfactory results in most experiments, and since this acid in this concentration did not appear to offer disadvantages, much of the subsequent study was completed with this acid as an addition to the dye solution.

IN PRETREATMENT———For dyeing light shades of nylon with acid and direct dyes, it was believed that no pretreatment was necessary. However, in order to study the possibility of dyeing heavy shades continuously, the influence of a pretreatment of the nylon cloth for improved color yield and its effect on wash fastness were observed. The following laboratory experiments were conducted on a limited number of dyes, namely:

Polar Red B
Polar Red R
Polar Orange R
Polar Yellow 2G
Alizarine Irisol R
Neotolyl Black TLA

The tests were conducted as follows:

1. Color padded at 160° F. and, without being dried, steamed for 15 seconds, 30 seconds and 180 seconds, respectively.

1a. Same as for No. 1, except that, after being steamed, the material was heat-treated for 10 seconds at 400°F. (flat iron).

2. Nylon cloth was first treated with a 2% solution of tannic acid at the boil for 15 minutes, rinsed and dried. Procedure then same as for No. 1.

2a. Same as for No. 2 except heat-treated as in No. 1a.

3. Cloth was first treated with a 2% solution of phenol for 15 minutes at boil, rinsed and dried. Continued as for No. 1.

3a. Same as for No. 3, except heat-treated.

4. Cloth was first treated with a 1% solution of cinnamic acid at the boil for 1 minute, rinsed and dried. Continued as for No. 1.

4a. Same as for No. 4, except heat-treated.

5. Cloth was treated with a 2% solution of salicylic acid at the boil for 1 minute, rinsed and dried. Continued as for No. 1.

5a. Same as for No. 5, except heat-treated.

6. Cloth was padded through a solution that contained 10% of formic acid, 85%. Procedure continued as for No. 1.

6a. Same as for No. 6 except heat-treated.

Based on these experiments, the following comments can be made:

For 1: In every case an increase in color value was obtained with the longer steaming time.

For 1a: It is indicated that heat-treatment, irrespective of presteaming time factor, improves wash fastness.

For 2: Tannic acid had a detrimental influence on shade and fastness properties.

For 2a: Same as No. 2.

For 3: Phenol caused a marked increase in color value and no apparent detrimental influence on wash fastness.

For 3a: Increased fastness in practically all cases.

For 4: Cinnamic acid had a marked influence on shade, but the true shade returned with washing. A notable increase in color value and no apparent detrimental influence on wash fastness.

For 4a: Same as No. 4.

For 5: Salicylic acid showed results comparable with No. 4 (cinnamic acid).

For 5a: Same as No. 5.

For 6: Formic acid showed a slight influence on shade. An increased color value is noted but not to the same degree as for cinnamic or salicylic acids. No apparent detrimental influence on wash fastness.

For 6a: Same as No. 6.

From these laboratory tests it was apparent that a pretreatment, for example, with salicylic or cinnamic acid, exerts a favorable influence on color yield and fastness.

The time available to this Committee did not permit a further investigation of the economic and practical aspects of the pretreatment process. The pretreatment effects are summarized in Table II.

PADDING AND STEAMING CONDITIONS

GENERAL———Padding of nylon fabrics and of other fabrics made of hydrophobic fibers is extremely difficult because of the low natural moisture absorption of those materials. It was found early in the experimental work that a considerable variation was caused by machine differences. An important consideration, as in materials made from all fibers, is the structure of the cloth. Certain nylon fabrics, even when padded with the greatest possible pressure, showed a pickup, which can be reduced considerably by centrifuging.

Some cloths appeared very wet after padding, indicating that there was excessive surface liquor, or "puddling", on the fabric. Careful observation during padding of some cloths showed that there appeared to be a film of dye liquor close to the nip, which broke as the cloth went through, causing puddles (i.e., wet places) on the cloth and a broken film of dye liquor on the rubber squeeze rolls. If the cloth traveled directly out of the nip and did not follow the contour of either of the padder rolls there was considerably less pickup than if the cloth travel followed one of the rolls of the padder. The

INFLUENCE OF ASSISTANTS IN PRETREATMENTS OF NYLON PIECE GOODS

TABLE IIa

Dye 2% Solution	Control No pretreatment Steam 15", 50", 180"		2% Tannic Acid Solution 15 Minutes at Boil Rinsed and Dried	
	A	B	A	B
Polar Red B	Longer steaming increases color value and wash fastness	Improved wash fastness; color value unchanged	Detrimental influence on shade and wash fastness	Detrimental influence on shade and wash fastness

The same effects were obtained for the following: Polar Red R, Polar Orange R, Polar Yellow 2G, Alizarine Irisol R, and Neotolyl Black TLA.

TABLE IIb

Dye 2% Solution	2% Phenol Solution 15 Minutes at Boil Rinsed and Dried		2% Cinnamic Acid Solution 1 Minute at Boil Rinsed and Dried	
	A	B	A	B
Polar Red B	Increase in color value; no detrimental influence on wash fastness	Same color value as A; slight improvement in wash fastness	Increase in color value; change in shade*; no influence wash fastness	Increase in color value change in shade*; no influence wash fastness
Polar Red R	Increase in color value; no detrimental influence on wash fastness	Same color value as A; slight improvement in wash fastness	Increase in color value; change in shade*; no influence wash fastness	Increase in color value; change in shade*; no influence wash fastness
Polar Orange R	Increase in color value; no detrimental influence on wash fastness	Same color value as A; improved wash fastness	Increase in color value; change in shade*; no influence wash fastness	Same as A, except improved wash fastness
Polar Yellow 2G	Increase in color value; no detrimental influence on wash fastness	Same color value as A; improved wash fastness	Increase in color value; no detrimental influence on wash fastness	Same as A
Alizarine Irisol R	Increase in color value; no detrimental influence on wash fastness	Same as A	Marked increase in color value; no influence on wash fastness	Same as A
Neotolyl Black TLA	Marked increase in color value; no detrimental influence on wash fastness		Marked increase in color value; no influence on wash fastness	Same as A

TABLE IIc

Dye 2% Solution	2% Salicylic Acid Solution 1 Minute at Boil Rinse and Dry		10% Formic Acid Solution Pad and Dry	
	A	B	A	B
Polar Red B	Essentially same as with cinnamic acid*	Essentially same as with cinnamic acid*	Slight increase in color value; no influence on wash fastness	Slight increase in color value; no influence on wash fastness
Polar Red R	Essentially same as with cinnamic acid*	Essentially same as with cinnamic acid*	Slight increase in color value; no influence on wash fastness	Slight increase in color value; no influence on wash fastness
Polar Orange R	Essentially same as with cinnamic acid*	Essentially same as with cinnamic acid*	Slight increase in color value; no influence on wash fastness	Slight increase in color value; no influence on wash fastness
Polar Yellow 2G	Essentially same as with cinnamic acid*	Essentially same as with cinnamic acid*	Slight increase in color value; no influence on wash fastness	Slight increase in color value; no influence on wash fastness
Alizarine Irisol R	Essentially same as with cinnamic acid*	Essentially same as with cinnamic acid*	Slight increase in color value; no influence on wash fastness	Slight increase in color value; no influence on wash fastness
Neotolyl Black TLA	Essentially same as with cinnamic acid*	Essentially same as with cinnamic acid*	Slight increase in color value; no influence on wash fastness	Slight increase in color value; no influence on wash fastness

A—Color padded and, without drying, steamed for periods indicated.
B—Same as A, plus heat-treatment for 10 seconds at 400°F.
*—True shade of color returns after washing.

reason for this is obvious since the cloth following the padder roll picks up the film of dye liquor that is squeezed through the nip and forms on the surface of the padder rolls as described. A simple method of reducing the dye pickup in padding nylon is to wrap both padder rolls with absorbent cotton cloth. It was possible to observe dye liquor squeezed from the nylon forming a film after going through padder rolls and the film being absorbed by the cotton cloth. The use of surface-active agents did not appear to cause a variation in the pickup.

The pickup was reduced considerably when a thickening agent or gum was used in the padding of nylon. This can be explained by the fact that the thickened dye solution adhered to the rubber rolls more strongly than a water film.

No experimental work was done in varying the hardness of the rubber pad rolls except that softer rubber rolls appeared to give a lower pickup.

The use of water alone to determine pickup: Nylon material was padded in one laboratory at low pressure with two soft rubber rolls; the pickup was 63.5 per cent. The same sample was then centrifuged in a Westinghouse Laundromat; the pickup dropped to 40.5 per cent. The experiment was repeated with a 0.45-per-cent solution of Metanil Yellow. The padded material was steamed for 15 seconds, washed and dried. The general appearance of the dyeing was poor and irregular because of the wetness of the cloth after padding. Another sample was impregnated with the same solution, centrifugally extracted and air-dried. In this case the dye was fixed by heat-setting for 1 minute at 450°F. The material was then washed and dried. The dye shade appeared to be somewhat lighter, but the general appearance and levelness were good. Work on plant dyeings to be described later, indicates the importance of a low and uniform dye pickup.

EFFECT OF LOW PICKUP vs. HIGH PICKUP ON DYE FIXATION——Considerable thought was given to the mechanism of the dyeing that takes place in padding and steaming. In general, all the dyes used, except Alizarine Supra Blue A, did not dye in the padder, and, if the padded pieces were washed without steaming, the dye washed off and only a slight stain remained on the padded material. It was thought that possibly a high concentration of dye with a very low pickup would give satisfactory color yield and better fastness than a low concentration of the same dye with a high pickup. The following experiments were made to determine whether this condition existed:

Brilliant Croceine M with the addition of 2 per cent of formic acid, 85%, in the dye bath was padded with high and low pickup at concentrations of ½, 1, and 1½

percent of dye.

The same series was run with Chlorantine Fast Yellow 5GLL with no addition to the dye bath.

After being padded with the dye solution, the cloth was steamed 15 seconds and then rinsed with a known volume of cold water. The amount of dye in the rinse water was determined by the General Electric Recording Spectrophotometer. Reflectance measurements were made on the dyed cloth and a value of 100 was given to the cloth dyed with ½ per cent of dye solution and with a low set on the padder. Patches were then given a No. 3 wash test and reflectance measurements were repeated on the cloth. An attempt to measure the amount of dye in the soap solution failed because of the high light diffusion of the soap itself. Even when soap was added to known amounts of dye, and the corresponding figures were taken as blanks, it was impossible to measure the amount of dye soaped off and to correlate this with the difference in the reflectance measurements between the soaped and not-soaped patches. A possible explanation of this effect is that nylon dyed in this experiment was not thoroughly penetrated, and the amount of dye washed off might exceed the amount obtained from the difference in reflectance measurements. R. J. Thomas and B. F. Faris *(13)* showed that it is very often impossible to correlate the amount of dye absorbed with reflectance measurements. Equal dye reflectance is shown on 1-denier single-filament fiber and 10-denier single-filament fiber, even though 1.6 to 2 times the amount of dye is absorbed by the 1-denier filament. The amount of dye absorbed was determined by these investigators by dissolving the nylon and the dye in orthochlorophenol at a temperature of 100°C. and by measuring the dye solution with the General Electric Recording Spectrophotometer. Time did not permit the use of this technique by this committee. The amounts of dye washed off after No. 3 wash tests are therefore not given.

The data in Tables III and IV are important in that they exhibit the effect of rates of dyeing and definitely indicate that Brilliant Croceine M with 2 per cent of formic acid has a greater dye affinity, or diffusion rate, that Chlorantine Fast Yellow 5GLL without acid. It is apparent that Brilliant Croceine M with formic acid builds up with increased concentration. For example, a 20-per-cent pickup from a 2-per-cent padding solution yields the same depth of shade as a 40-per-cent pickup from a 1-per-cent padding solution. However, padding conditions might be very important with this dye because a blotchy or unevenly squeezed material going into the steamer would undoubtedly produce an uneven dye fixation. In the case of Chlorantine Fast Yellow 5GLL with no additions to the dye solution, the dyeing rate is so low that concentration and dye-solution pickup are not factors since only a small amount of dye is fixed. Under these conditions, this dye should not be used in continuous work.

TABLE III

EFFECT OF DYE PICKUP, PADDING AND STEAMING OF NYLON FABRICS

Brilliant Croceine M with 2% of formic acid, 85%	*L1*	*H1*	*L2*	*H2*	*L3*	*H3*
Amount of dyestuff in solution, %	0.5	0.5	1.0	1.0	1.5	1.5
Weight of original sample, g	1.58	1.53	1.64	1.52	1.55	1.48
Pickup on pad, g	.63	.33	.63	.37	.56	.37
Pick up pad, %	40.0	21.2	38.1	24.7	36.0	25.0
Amount of dye on cloth after padding, mg.	3.17	1.63	6.26	3.74	8.37	5.56
Amount of dye in rinse water, mg.	.06	.06	.30	.12	1.03	.53
Amount of dye remaining on cloth, mg.	3.11	1.57	5.96	3.62	7.34	5.03
Dyeing, %	.20	.10	.36	.23	.47	.34
Relative depth of shade	100	69	188	139	225	181
Strength of shade after soap test	66	43	129	98	142	126
Relative depth of shade of cloth after soap test*	66	57	64	70	64	68

*—From a value of 100 for each sample before the soap test.
L—20 lb. p.s.i on padder.
H—60 lb. p.s.i. on padder.

EFFECT OF pH ON PICKUP——The effect of acid is very marked when dyed patches are compared. In general, where an acid, direct, or premetallized dye is soluble in an acid solution, better color yield is obtained when nylon cloth is padded and steamed with acid added to the padding solution. To determine whether the effect is caused by a higher dye pickup resulting from the addition of acid to the padding solution or better fixation, the dye pickup was measured at varying acid concentrations. The results are shown in Table V.

The effect on yield was determined in another group of tests. 1% of Brilliant Croceine M dissolved in distilled water was padded on shirting-weave nylon.

1. with no acid — pH 8.06
2. with ½% formic acid — pH 2.62
3. with 2% formic acid — pH 2.21

The dye-solution pickup from padding was determined to be 23 per cent. Two-gram samples were padded and treated as follows:

(a) Rinsed in 100 ml. of distilled water for 2 hours.
(b) Steamed 15 seconds, then rinsed as in (a).
(c) Steamed 1 minute, then rinsed as in (a).
(d) Steamed 15 seconds, air-dried, heat-set 15 seconds at 400° F., then rinsed as in (a).

The dye in the rinse water was determined colorimetrically with Nessler tubes. The results are shown in Table VI.

The significance of these results is that the addition of acid to the dye solution greatly increases the rate of dye absorption. In continuous work this effect is important. However, as will be shown, in plant dyeings the use of acid is not desirable with many dyes on certain cloth constructions.

EFFECT OF HEAT-SETTING AND TEMPERATURE OF DYEBATH ON PICKUP——A nylon shirting-weave fabric was boiled off on the jig with 0.25% of Nacconol and 0.25% of soda ash, then washed, finished on the jig with one

TABLE IV

EFFECT OF DYE PICKUP, PADDING AND STEAMING OF NYLON FABRICS

Chlorantine Fast Yellow 5GLL with no additions	*L1*	*H1*	*L2*	*H2*	*L3*	*H3*
Amount of dyestuff in solution, %	0.5	0.5	1.0	1.0	1.5	1.5
Weight of original sample, g	1.78	1.87	1.83	1.81	1.73	1.80
Pickup on pad, g	.65	.55	.66	.48	.59	.49
Pickup on pad, %	36.3	29.0	36.0	26.0	34.0	25.0
Amount of dye on cloth after padding, mg.	3.23	2.75	6.60	4.76	8.88	7.32
Amount of dye in rinse water, mg.	0.75	0.35	5.37	2.24	6.40	4.58
Amount of dye remaining on cloth, mg.	2.48	2.40	1.23	2.52	2.48	2.74
Dyeing, %	.14	.13	.07	.13	.14	.15
Relative depth of shade	100	109	147	142	168	149
Strength of shade after soap test	50	70	57	72	93	74
Relative depth of shade of cloth after soap test*	50	64	39	51	55	51

Data given under L2 are inconsistent.

*—From a value of 100 for each sample before the soap test.
L—20 lb. p.s.i on padder.
H—60 lb. p.s.i. on padder.

TABLE V

VARIATION IN PICKUP CAUSED BY ACID IN 1% BRILLIANT CROCEINE M, PADDED AT 140°F. ONTO DOBBY-STYLE NYLON CLOTH PREPARED IN USUAL MANNER

Acid	*pH*	*Pickup, %*
None	8.42	24.0
2% Formic acid, 85%	2.35	24.5
10% Formic acid, 85%	1.50	24.0
1% Sulfuric acid, 66° Bé	1.00	26.0

No influence on pickup was observed.

TABLE VI

VARIATION IN DYE ABSORPTION WITH CONCENTRATION OF ACID; TWO-GRAM SAMPLES OF NYLON CLOTH PADDED WITH 1% BRILLIANT CROCEINE M

(Pickup 23% = 4.6 mg. of dye)

	Acid	*pH*	*Dye in Rinse Water, mg.*	*Dye on Cloth, mg.*	*Dyeing, %*	*Yield, %*
(a)	None	8.06	3.0	1.0	0.05	
(b)	None	8.06	2.1	2.5	.13	54.4
(c)	None	8.06	.8	3.8	.19	82.6
(d)	None	8.06	.3	4.3	.22	93.5
(a)	0.25% Formic	2.62	4.0	.6	.03	
(b)	.25% Formic	2.62	1.6	3.0	.15	65.1
(c)	.25% Formic	2.62	.4	4.2	.21	91.4
(d)	.25% Formic	2.62	.8	3.8	.19	82.6
(a)	2% Formic	2.21	4.0	.6	.03	
(b)	2% Formic	2.21	1.0	3.6	.18	78.4
(c)	2% Formic	2.21	.1	4.5	.23	98.0
(d)	2% Formic	2.21	.4	4.2	.21	91.4

pint of acetic acid, and dried on the frame at low temperature. Samples of this fabric were heat-set in the laboratory for 15 seconds at 400°F. in a laboratory oven with forced circulation. Samples of heat-set and not-heat-set fabric were padded through a dyebath made up with 1 per cent of Alizarine Cyanine Green and with 2 per cent of formic acid. The temperature of the padder bath was 100°, 129° and 175°F. The padded rolls were heated by pouring the dye solution over the rolls before padding. After the cloth was padded, it was placed in a closed weighing bottle and weighed immediately. The results of the effect of temperature of the padder bath on pickup and the effect of heat-setting are tabulated in Table VII. It is obvious that heat-setting and temperature of the dyebath do not affect the pickup.

STUDY OF MOISTURE ABSORPTION IN STEAMING———The high dyeing rate of nylon fabrics by acid, premetallized and direct dyes at high temperatures, and the comparatively low rate of dyeing at temperatures below 180° has not been explained satisfactorily. Relative humidity studies at equilibrium *(14)* indicated that at 75°F. and 90 per cent relative humidity, nylon absorbs 6.70 per cent moisture. No data are available showing the moisture absorption at 100 per cent relative humidity and at 212°F., as under the conditions of steaming. It was believed that possibly the moisture absorption would be considerably higher and for that reason there would be a greater swelling of the nylon fiber, permitting greater diffusion of the dye into the fiber. In one laboratory the measurement of moisture under steaming conditions was completed. A Roller-Smith yarn balance was mounted approximately 2 feet above a laboratory steamer. A hole drilled in the base of the yarn balance and another hole in the same vertical line drilled into the laboratory steamer made it possible to suspend nylon cloth in the steamer and to weigh the cloth continuously to determine the moisture absorption. Results are given in Table VIII.

The nylon absorbs moisture rapidly, but the total absorption is not appreciably greater than at 75°F.

A similar study was completed by wetting the nylon material with approximately 30 per cent of moisture and placing the sample in the steamer. The weight remained constant during the 15-minute period of the experiment.

TREATMENTS TO IMPROVE WASH FASTNESS———Dyeings were made in several laboratories according to the general procedure of padding, steaming and rinsing with cold water. AATCC No. 3 wash-fastness test method for manufactured organic fibers indicated that in many cases the wash fastness was very poor. However, in most instances the general appearance of the dyeings was satisfactory. A series of aftertreatments was

TABLE VII

EFFECT OF HEAT-SETTING AND TEMPERATURE OF DYEBATH ON PICKUP
1% ALIZARINE CYANINE GREEN

Temperature, °F.	*Set*	*Dry Weight of Sample, g.*	*Wet Weight of Sample, g.*	*Pickup, g*	*Pickup, %*
100	No	2.94	3.77	0.83	28.3
100	Yes	3.17	4.10	.93	29.2
129	No	3.05	3.90	.85	27.7
129	Yes	3.04	3.90	.86	28.4
175	No	3.10	4.04	.94	30.2
175	Yes	2.92	3.75	.83	28.3

TABLE VIII

MOISTURE ABSORPTION OF DRY NYLON IN STEAM

Time Minutes	*Weight of Nylon, g.*	*Gain in Weight, g.*	*Moisture Absorption, %*
0	1.93	0.00	0.00
1	1.98	.06	2.86
2	1.99	.07	3.38
3	2.01	.08	4.15
5	2.04	.12	5.98
8	2.06	.13	6.76
11	2.07	.15	7.54
15	2.07	.15	7.54

TABLE IX
TREATMENTS TO IMPROVE WASH FASTNESS

Dye	Conc., %	Acid	Steam Time 15 sec. Yield	Steam Time 15 sec. Appearance	Steam Time 15 sec. No. 3 Wash	Treatment on Dry Cloth 30 sec. at 400°F. Appearance	Treatment on Dry Cloth 30 sec. at 400°F. No. 3 Wash	Treatment on Dry Cloth 60 sec. at 440°F. Appearance	Treatment on Dry Cloth 60 sec. at 440°F. No. 3 Wash	Treatment on Dry Cloth 60 sec. at 420°F. Appearance	Treatment on Dry Cloth 60 sec. at 420°F. No. 3 Wash	Treatment on Dry Cloth 60 sec. at 400°F. Appearance	Treatment on Dry Cloth 60 sec. at 400°F. No. 3 Wash	Treatment on Dry Cloth 90 sec. decatized Appearance	Treatment on Dry Cloth 90 sec. decatized No. 3 Wash
Neutracyl Blue G	0.5	None	S	S	P	NC	S	P; lighter, Y	S					NC	P
Neutracyl Blue G	3	None	S	S	P	NC	F	S; NC	S					NC	P
Neutracyl Blue G	0.5	2% formic	P	Y	P	NC	P	P; Y, D	P			Y, D	P		
Neutracyl Blue G	3	2% formic	P	Y	P	NC	P	P; Y, D	P			Y, D	P		
Neutracyl Black N	0.5	None	S	S	F	NC	S	P; bluer, D	F					NC	P
Neutracyl Black N	3	None	S	S	P	NC	F	P; bluer, D	P					NC	P
Neutracyl Yellow N	3	None	S	S	P	NC	S	P; red, D	S					NC	F
Neutracyl Yellow N	0.5	2% formic	S	S	F	NC	F			S; D	S	S; D	S		
Neutracyl Yellow N	3	2% formic	S	S	P	NC	S			S; D	S	S; D	S		
Pontamine Fast Orange 2GL	0.5	2% formic	S	S	F	D	F			S; D	S	S; D	S		
Chrysophenine	0.5	2% formic	S	S	F	D	F			S; D	S	S; D	S		
Anthraquinone Violet	0.5	2% formic	S	S	F	D	F			S; D	P	S; D	F		
Du Pont Milling Red SWB 125%	0.5	2% formic	S	S	S	D	S			S; D	S	S; D	S		
Diamine Scarlet B	0.5	2% formic	S	S	S	D	S			P; Y, lighter	S	Y; D	S		

S = Satisfactory
P = Poor
F = Fair
NC = No Change
Y = Yellowed
D = Darker

therefore investigated to improve wash fastness. The results are tabulated in Table IX. These results indicated the need for a more quantitative evaluation of the aftertreatments. A selection was made of some of the dyes for this study. The results are discussed in connection with Table XI of this paper. Dry-heat treatments, such as 20 hours at 200°F. or 10 minutes at 300°F., did not improve wash fastness. However, steaming for 10 minutes or heating at 400°F., or above in many cases, improved the wash fastness considerably.

Another series of trials was completed in a laboratory where the dye solutions were padded on nylon cloth. The padded samples were steamed continuously for 30 seconds, rinsed with cold water and dried. The treatments were made by heat-setting and dry-steaming. The results are tabulated in Table X.

CLASSIFICATIONS OF DYES BY DYEING PROPERTIES———As this investigation progressed, it was believed advisable to confine part of the study to the production of light shades. It has been found (a) that certain colors were fixed on nylon without the addition of any assistant and (b) that heat setting after steaming, rinsing and drying improved the wash fastness. Accordingly, an extensive plan of study was prepared to obtain the following information:

1. Build-up in depth of shade. Dyestuff concentrations were 0.25%, 0.5%, 1% and 1.5%.
2. Effect of steaming time upon depth of shade and wash fastness. Padded patches were steamed 15 seconds, 30 seconds, 1 minute, 5 minutes and 15 minutes.
3. Effect upon depth of shade and wash fastness of the presence or absence of 2% of formic acid, 85%, in the dye solution.
4. Effect of subsequent heat-setting upon depth of shade and wash fastness.

TABLE X
TREATMENTS TO IMPROVE WASH FASTNESS

Dye	Conc. %	Formic Acid	Yield	Appearance	No. 3 Wash	Heat-set at 400°F. 30 sec. Appearance	Heat-set at 400°F. 30 sec. No. 3 Wash	Resteamed 10 min. Appearance	Resteamed 10 min. No. 3 Wash
Neutracyl Yellow N	2.00	No	S	E	F	D	S	NC	S
Sulphon Cyanine 5R 1/1	.07	No	S	E	F	NC	S	D	S
Alizarine Cyanine Green GN 1/1									
Chromolan Grey G 1/—	20	No	S	E	F	NC	S	NC	S
Alizarine Cyanine Green GN 1/—									
Sulphon Cyanine 5R 1/—	.75	No	S	E	F	NC	S	NC	S
Alizarine Sky Blue B	.10	No	F	E	P	NC	F	NC	F
Alizarine Sky Blue B	.10	Yes	S	E	P	NC	F	NC	F
Neutracyl Yellow 3RA 1/1									
Neutracyl Blue G 1/1	.20	No	S	E	F	NC	S	NC	S
Alizarine Cyanine Green GN 1/1									
Neutracyl Blue G 1/1	.10	No	S	E	F(Bluer)	NC	S	NC	S
Neolan Orange R	.10	No	S	E	F	NC	S	NC	S
Neolan Orange R	.10	Yes	S	E	F	NC	S	NC	S
Neutracyl Yellow R 2/1									
Neutracyl Blue G 2/1	6.00	No	F	F	P(Bluer)	D	S	NC	S

P = Poor
F = Fair
S = Satisfactory
E = Excellent
NC = No Change
D = Darker

Experiments were completed under all the conditions as stated, including variations in dye concentration, steaming time and presence or absence of 2% of formic acid, 85%. The steamed samples were rinsed and dried. Each patch was then divided, and one sample was heat-set for 15 seconds at 420°F. Both samples were then given two AATCC No. 3 wash tests. The depth of shade of each sample before the first wash test, after the first wash test, and after the second wash test was measured in a General Electric Recording Spectrophotometer. The tabulation of the results of this study, which is given in Table XI, led to the conclusion that the dyes that might be considered for application on nylon by the pad-steam process are materially affected by conditions and should be classified according to the following groups:

I. DEPTH OF SHADE OBTAINED IS NOT AFFECTED BY STEAMING TIME.

II. DEPTH OF SHADE OBTAINED IS MATERIALLY AFFECTED BY STEAMING TIME.

III. MAXIMUM DEPTH OF SHADE OBTAINED WHEN ACID IS PRESENT.

IV. MAXIMUM DEPTH OF SHADE OBTAINED WHEN NO ACID IS PRESENT.

The number of variations of different factors required 240 tests on each dye investigated. Because of the limitation of time in the preparation of this paper, it was impossible to obtain complete data on the colors desired. Enough data were obtained, however, to indicate the wide differences of results with individual dyes. The data tabulated clearly demonstrate the necessity for a thorough and extensive testing of any dye that is proposed for this process.

One factor which is consistent throughout is that an increase in the time of steaming, or heat-setting of the fabric, increases the fastness to washing. The other properties were diverse for different dyes. A discussion of each individual dye indicates the variations in the results obtained.

Sulphon Cyanine 5R: The addition of formic acid to a solution of this dye tended to cause precipitation, and the dyeings were spotty. Data are given covering the application of this dye, which show that it is not satisfactory for use in acid solution. When applied without acid, however, it gives satisfactory results and has several advantages. The strength of the dyeings builds up with increased concentrations, short steaming is practically as effective as long steaming, and wash fastness is excellent even without heat setting.

Neolan Orange R: This dye is satisfactory with or without acid, builds up progressively with increasing concentrations, and the depth of shade is not materially increased with longer steaming. The wash fastness is somewhat better when the dye is applied without acid and, in either case, is improved by longer steaming time or by heat-setting.

Alizarine Supra Blue A: This dye requires the presence of acid to obtain satisfactory color yield and build-up in depth of shade. When acid is present, increased steaming time has very little effect. The wash fastness is only fair, which is improved but slightly with increased steaming time or heat-setting.

Brilliant Croceine M: The results obtained with this dye were very interesting and warranted a plant run. When acid is present, the depth of shade builds up with increased concentration. Increased steaming time has no effect on color yield until the concentration of dye in solution exceeds 1 per cent. The wash fastness is excellent even with short steaming and improves as the time of steaming increases.

Without acid present, a considerably longer steaming time is necessary in order to obtain color yield and wash fastness comparable with the results with acid. Heat-setting gives materially increased wash fastness.

Xylene Light Yellow 2G: Whether applied with or without acid this dye requires a long steaming time in order to obtain satisfactory color yield. The fastness to washing improves greatly with increased steaming time or heat-setting. This dye, which is affected so much by steaming time, would be liable to produce widely varying results under different steaming conditions.

Alizarine Cyanine Green: When applied with acid present, this dye builds up very well, gives satisfactory results with short steaming time, and has fair wash fastness, which is materially improved with longer steaming. When applied without acid, a longer steaming time is required to obtain comparable color yield or wash fastness. The wash fastness is improved greatly by heat-setting.

Alizarine Fast Light Blue C: This dye

TABLE XIa
SULPHON CYANINE 5R, C.I. 289

STEAMING TIME	15 sec.	30 sec.	1 min.	5 min.	15 min.
2% FORMIC ACID—NOT HEAT SET					
0.25% Dye Solution					
Original	100	102	108	107	113
After 1st Wash Test	52	57	66	83	81
After 2nd Wash Test	46	41	63	76	78
0.5% Dye Solution					
Original	210	229	223	245	251
After 1st Wash Test	49	49	76	86	91
After 2nd Wash Test	39	43	63	78	89
1% Dye Solution					
Original	445	675	745	630	720
After 1st Wash Test	61	68	80	92	92
After 2nd Wash Test	47	58	64	82	88
1.5% Dye Solution					
Original	900	1050	1080	1175	1420
After 1st Wash Test	57	..	74	81	94
After 2nd Wash Test	48	..	66	76	95
2% FORMIC ACID—HEAT SET					
0.25% Dye Solution					
Original	118	105	104	94	112
After 1st Wash Test	90	87	91	94	95
After 2nd Wash Test	90	77	89	90	92
0.5% Dye Solution					
Original	196	235	226	226	230
After 1st Wash Test	91	93	99	98	104
After 2nd Wash Test	87	82	86	88	84
1% Dye Solution					
Original	460	735	650	760	720
After 1st Wash Test	95	78	98	82	75
After 2nd Wash Test	89	71	83	82	72
1.5% Dye Solution					
Original	990	1190	1080	1130	1430
After 1st Wash Test	96	95	93	95	99
After 2nd Wash Test	86	89	87	88	100
WITHOUT FORMIC ACID—NOT HEAT SET					
0.25% Dye Solution					
Original	520	515	550	580	610
After 1st Wash Test	85	89	89	95	99
After 2nd Wash Test	82	88	70	95	102
0.5% Dye Solution					
Original	1000	870	910	1000	1070
After 1st Wash Test	82	87	93	95	85
After 2nd Wash Test	82	84	92	97	99
1% Dye Solution					
Original	1370	1505	1350	1570	1750
After 1st Wash Test	67	75	87	91	93
After 2nd Wash Test	60	75	86	102	95
1.5% Dye Solution					
Original	1910	1790	1920	2250	2560
After 1st Wash Test	67	82	85	103	95
After 2nd Wash Test	63	78	88	98	94
WITHOUT FORMIC ACID—HEAT SET					
0.25% Dye Solution					
Original	480	490	590	570	590
After 1st Wash Test	94	92	97	93	102
After 2nd Wash Test	87	88	93	92	97
0.5% Dye Solution					
Original	980	870	820	920	1000
After 1st Wash Test	93	98	94	102	92
After 2nd Wash Test	80	87	91	93	97
1% Dye Solution					
Original	1400	1600	1300	1610	1710
After 1st Wash Test	82	86	89	91	93
After 2nd Wash Test	72	73	81	88	95
1.5% Dye Solution					
Original	1810	1900	1990	2150	3200
After 1st Wash Test	88	90	91	95	69
After 2nd Wash Test	80	80	90	86	84

has a very limited solubility and cannot be used in concentrations greater than 0.5 per cent. When applied in lower concentrations in the presence of acid, it gives satisfactory color yield with short steaming, and the dyeings have fair wash fastness.

Neutracyl Blue G: When this dye is applied with acid it requires only a short steaming time (15 seconds), and the dyeings obtained have excellent wash fastness. Heat-setting produces a slight improvement.

TABULATION OF DATA

ORIGINAL———The data in Table XI are relative strengths of dye on a sample at indicated steaming times and dye concentrations versus the sample prepared with 0.25% of dye and 2% of formic acid, 85%, steamed 15 seconds and taken as 100% unless otherwise specified.

WASH FASTNESS———The data given are relative strengths of dye on sample after a wash test, compared with the same sample before a wash test as 100%.

DYEING OF COMPOUND SHADES ———Many difficulties have been encountered in the dyeing of nylon with a mixture of dyes of the acid and direct types. In some cases one dye *blocks off* another dye completely. Fidell, Royer and Millson *(16)* use the term "preferential sorption" to describe this phenomenon. They state that the factors associated with the sorption of dye by nylon are saturation value, rate and affinity. These factors depend on the chemical and physical nature of the fiber, pH of the dyebath, liquor ratio, dye concentration, temperature, etc. Therefore, if any one of these conditions is varied, the sorption characteristics may vary. Under the same conditions the sorption characteristics of two different dyes may be entirely different (See Table XI). The dyeing of compound shades by padding and steaming is made considerably easier because temperature, time and liquor ratio can be maintained constant. Dyes that are in the same classification with respect to dyeing properties (see discussion preceding Table XI) should dye satisfactorily together. Many plant dyeings have been made successfully with mixtures of dyes. Both time and rate of dyeing have an effect on the resulting shade, and can be anticipated by studying Table XI of this report.

Two plant trials were completed in an attempt to dye an O.D. 7 shade. The two dyes used were Neutracyl Blue G and Neutracyl Yellow N. In one case when the steaming time was 12 seconds, more blue than yellow was necessary to get the correct shade. In another plant the reverse was found, when the steaming time could be increased to 1.5 minutes. In the latter instance more yellow was used than blue. A study of the rates of fixation or dyeing investigated in Table XI readily explains this phenomenon.

As will be shown in the Discussion of the Results, dyeing by padding and steaming takes place in two steps: *First,* the ab-

TABLE XIb

NEOLAN ORANGE R, Pr. 146

STEAMING TIME	*15 sec.*	*30 sec.*	*1 min.*	*5 min.*	*15 min.*
WITH ACID—NOT HEAT SET					
0.25% Dye Solution					
Original	100	108	111	114	119
After 1st Wash Test	45	49	53	74	83
After 2nd Wash Test	31	39	46	66	77
0.5% Dye Solution					
Original	108	188	187	199	203
After 1st Wash Test	36	60	66	82	87
After 2nd Wash Test	29	51	57	74	58
1% Dye Solution					
Original	277	310	315	342	340
After 1st Wash Test	53	67	84	87	88
After 2nd Wash Test	44	57	73	76	84
1.5% Dye Solution					
Original	251	360	420	420	430
After 1st Wash Test	46	69	84	89	87
After 2nd Wash Test	34	63	71	83	81
WITH ACID—HEAT SET					
0.25% Dye Solution					
Original	106	104	107	107	113
After 1st Wash Test	75	73	75	83	90
After 2nd Wash Test	68	65	68	77	83
0.5% Dye Solution					
Original	125	188	189	192	191
After 1st Wash Test	75	88	84	89	93
After 2nd Wash Test	67	77	77	83	91
1% Dye Solution					
Original	298	319	308	342	340
After 1st Wash Test	85	80	88	9[illegible]	93
After 2nd Wash Test	74	73	80	[illegible]6	90
1.5% Dye Solution					
Original	254	352	430	425	420
After 1st Wash Test	73	88	86	91	88
After 2nd Wash Test	65	79	77	86	87
WITHOUT ACID—NOT HEAT SET					
0.25% Dye Solution					
Original	99	101	106	105	108
After 1st Wash Test	67	72	77	85	87
After 2nd Wash Test	61	66	68	79	86
0.5% Dye Solution					
Original	152	149	147	165	154
After 1st Wash Test	67	71	82	89	96
After 2nd Wash Test	59	63	77	85	60
1% Dye Solution					
Original	298	277	299	330	319
After 1st Wash Test	68	72	77	87	93
After 2nd Wash Test	58	63	65	81	91
1.5% Dye Solution					
Original	360	349	349	370	380
After 1st Wash Test	61	71	79	93	91
After 2nd Wash Test	56	65	75	87	93
WITHOUT ACID—HEAT SET					
0.25% Dye Solution					
Original	103	99	103	104	103
After 1st Wash Test	73	81	83	85	93
After 2nd Wash Test	66	74	77	81	89
0.5% Dye Solution					
Original	150	152	150	164	160
After 1st Wash Test	80	78	88	88	93
After 2sd Wash Test	72	71	76	84	91
1% Dye Solution					
Original	310	280	309	320	335
After 1st Washt Test	77	80	86	91	92
After 2nd Wash Test	73	72	79	85	86
1.5% Dye Solution					
Original	336	355	356	370	400
After 1st Wash Test	80	84	86	95	91
After 2nd Wash Test	74	75	80	88	87

TABLE XIc

BRILLIANT CROCEINE M, C.I. 252

STEAMING TIME	15 sec.	30 sec.	1 min.	5 min.	15 min.
WITH ACID—NOT HEAT SET					
0.25% Dye Solution					
Original	100	100	97	110	103
After 1st Wash Test	59	65	69	76	78
After 2nd Wash Test	51	53	54	62	71
0.5% Dye Solution					
Original	199	182	188	178	202
After 1st Wash Test	66	70	78	85	80
After 2nd Wash Test	56	55	62	72	70
1% Dye Solution					
Original	348	348	420	395	359
After 1st Wash Test	63	68	72	76	72
After 2nd Wash Test	52	53	57	63	59
1.5% Dye Solution					
Original	440	430	560	700	690
After 1st Wash Test	60	68	71	71	75
After 2nd Wash Test	49	53	68	54	63
WITHOUT ACID—HEAT SET					
0.25% Dye Solution					
Original	41	56	89	99	120
After 1st Wash Test	37	39	56	75	76
After 2nd Wash Test	27	29	44	70	67
0.5% Dye Solution					
Original	92	121	131	193	210
After 1st Wash Test	76	53	63	76	73
After 2nd Wash Test	35	42	50	63	75
1% Dye Solution					
Original	101	193	252	345	388
After 1st Wash Test	30	52	57	73	79
After 2nd Wash Test	32	36	48	60	68
1.5% Dye Solution					
Original	117	182	207	415	500
After 1st Wash Test	42	48	44	66	74
After 2nd Wash Test	32	38	35	54	64
WITHOUT ACID—HEAT SET					
0.25% Dye Solution					
Original	33	48	81	104	109
After 1st Wash Test	69	74	80	84	92
After 2nd Wash Test	57	59	67	72	81
0.5% Dye Solution					
Original	86	125	151	191	188
After 1st Wash Test	81	80	86	90	89
After 2nd Wash Test	65	67	70	80	84
1% Dye Solution					
Original	113	220	261	320	385
After 1st Wash Test	68	90	83	89	85
After 2nd Wash Test	56	71	72	76	74
1.5% Dye Solution					
Original	126	182	269	440	480
After 1st Wash Test	69	75	68	85	85
After 2nd Wash Test	55	62	55	70	71

sorption of the dye, and *second*, the fixation or chemical bonding. In plant dyeing by the conventional methods where the liquor ratio is usually 10 or 20 to 1, where temperatures are relatively high, and where the length of time in the dyebath is relatively great, sorption and chemical bonding probably take place at much the same time. Under these conditions of dyeing, the dye with the greatest chemical affinity will occupy the reactive amino sites to the exclusion of another dye in the same dye mixture. The dye with low affinity can only be slightly sorbed because of relatively low concentration. With the high dye concentrations, 50 to 100 times as great, in pad steaming, and relatively short time of steaming, sorption of a mixture of dyes of the same general affinity, as shown in Table XI, is uniform.

Total dye absorbed in pad-steam dyeing is considerably less than the saturation value of the nylon fiber. Further treatments by steaming or heat setting are often necessary before chemical bonding of the dyes making up the mixture takes place and the expected shade is obtained.

A striking experiment illustrating this blocking effect was completed without the use of acid. Dyebaths were made up as follows:

1. ½ 0.5% Brilliant Croceine M
   ½ 0.5% Alizarine Acid Yellow GS
2. ½ 0.5% Fast Acid Yellow GS
   ½ 0.5% Alizarine Supra Blue A
3. ½ 0.5% Alizarine Supra Blue A
   ½ 0.5% Brilliant Croceine M

Nylon fabric was padded at 170°F. air-dried and steamed 15 minutes. Another sample was jigged in the same mixture at 170°F. until it reached the same depth of shade as the sample that was padded. It was given a cold wash and dried.

Results:

Pad and Steam	*Jigged*
1. Orange	Clear Yellow
2. Green	Green
3. Violet	Clear Blue

It is evident that the Brilliant Croceine M did not dye in the jig under neutral conditions and at a temperature of 170°F. Another fact of interest was that, in the case of the jigged patches, considerable warpiness was evident, whereas no warpiness was evident when the dyeings were made by padding and steaming.

PLANT DYEINGS

PLANT TRIAL NO. 1———A plant trial was conducted to determine whether the laboratory results obtained would be duplicated on full-size plant equipment.

The pad formulation was prepared by dissolving 4 pounds of Brilliant Croceine M in 3 gallons of hot water. This solution was added to the feed tank and made up to 50 gallons. Then, 8 pints of formic acid, 85%, was added and the mix was thoroughly stirred. There was no precipitation of dye on the addition of the formic acid.

The fabric was padded at 90 yards a a minute. The immersion time was approximately one-quarter of a second. A single nip was used and the Durometer reading of the bottom roll was 60 and of the top, 90. A normal amount of set was applied, and the wet pickup was computed to be 20 per cent.

The fabric next passed over a compensating and expansion roll into the steamer for a 14-second passage at 220°F. The fabric then passed through a cold rinse in a Williams unit, to which had been added 1 pint of formic acid, 85%. The regular nip was used to remove the excess water. The fabric was allowed to plait down in a truck, which was then taken to frames where the cloth was frame-dried to 38.5 inches. The three blowers were operating during the drying process. An important result observed in these plant trials was that there was no migration of color and no clip marks were noticeable.

PLANT TRIAL NO. 2———

a. 1% Chlorantine Fast Yellow 5GLL —no addition of acid.
b. 1% Alizarine Supra Blue A, plus 2% of formic acid, 85%.
c. 1% Chlorantine Fast Yellow 5GLL, plus 2% of formic acid, 85%.
   1% Alizarine Supra Blue A—no addition of acid.

This trial was completed using the same procedure as No. 1, in the same

plant, and poor results were obtained. The results obtained in the fastness tests are given in Table XIII.

PLANT TRIAL NO. 3———1% Alizarine Supra Blue A, with no addition of acid. This trial was completed in the same plant, under exactly the same conditions as No. 1 and No. 2. Parachute cloth was used and the general appearance was excellent. The wash fastness was poor, which is an inherent characteristic of Alizarine Supra Blue A.

PLANT TRIAL NO. 4———

a. 1% Alizarine Supra Blue A, with no addition of acid.
b. 1% Alizarine Supra Blue A, plus 2% of formic acid, 85%.

Various cloths were investigated, including a taffeta as in Trial No. 2, a parachute cloth as in Trial No. 3, and a shirting weave of loose construction. Where no addition of formic acid was made, the appearance of all cloths was excellent. When 2% of formic acid, 85%, was used, the general appearance of all cloths was uneven and mottled, with one exception, as in Plant Trial No. 2. The depth of shade was somewhat heavier when formic acid was used in the formulation. The one cloth that had a satisfactory appearance was the shirting weave with a loose construction.

These trials indicated that the rate of dyeing and steaming had a tremendous influence on the results obtained. The dyes that fix rapidly in the steaming process have a tendency to dye unevenly. Consequently, these dyes require very careful padding.

PLANT TRIAL NO. 5———In another plant, dyeings were made with

a. 1% Alizarine Cyanine Green GN, plus 2% of formic acid, 85%.
b. 1% Alizarine Supra Blue A, plus 2% of formic acid, 85%.
c. 0.05% Alizarine Sky Blue B, plus 2% of formic acid, 85%.

Two types of cloth were used, a shirting weave of loose construction and a 9-yard taffeta. Dyeings were made in a range consisting of a light padder with a metal bottom roll and a rubber top roll of medium hardness, a steamer and five wash boxes. The two cloths were sewed together for each dyeing.

Temperature of dye in padder, °F.	155
Speed of machine (yds./min.)	50
Time in steamer (seconds)	28
Steaming temperature, °F.	220
Wash boxes	cold water
Dye pickup, %, Taffeta	41.6
Shirting weave	38.1

It was observed during these dyeings that the top rubber padder roll was uniformly moist when the shirting-weave fabric was in process. However, when the taffeta was run under identical padding conditions, the top rubber padder roll showed excess liquor distributed unevenly on the surface, and the fabric showed wet areas after padding and before steaming. The finished fabric was very spotty. These dyeings had fair wash fastness and were improved by an aftertreatment. The results obtained are shown in Table XIII.

PLANT TRIAL NO. 6———Dobby-weave light nylon-shirting fabric was dyed using the same equipment as in Trial No. 5.

a. Blue
6.5 oz. Sulphon Cyanine 5R

50 gal.
Time in steamer (sec.) 60
Temperature of dye in padder, °F. 140
Temperature of dye in padder, °F. 140
Dye pickup assumed to be approximately 40%.

b. 1 lb., 10 oz. Neutracyl Yellow N

50 gal.
Time in steamer (sec.) 90
Temperature of steamer, °F. 218
Temperature of dye in padder, °F. 140

c. Green
6.5 oz. Alizarine Cyanine Green
6.5 oz. Neutracyl Blue G

50 gal.
Time in steamer (sec.) 90
Temperature of steamer, °F. 218
Temperature of dye in padder, °F. 133

d. Grey
1 lb., 10 oz. Chromolan Grey G

50 gal.
Time in steamer (sec.) 90
Temperature of steamer, °F. 222
Temperature of dye in padder, °F. 136

No difficulties were experienced in completing any of these dyeings. The general appearance of the fabrics was excellent, and fastness tests in general were fair to satisfactory, without aftertreatment. The results are tabulated in Table XIII.

TABLE XId

XYLENE LIGHT YELLOW 2G, C.I. 639

STEAMING TIME	15 sec.	30 sec.	1 min.	5 min.	15 min.
WITH ACID—NOT HEAT SET					
0.25% Dye Solution					
Original	100	138	191	258	360
After 1st Wash Test	57	64	60	77	75
After 2nd Wash Test	47	56	52	67	63
0.5% Dye Solution					
Original	158	200	285	430	480
After 1st Wash Test	64	73	75	92	80
After 2nd Wash Test	51	57	65	73	64
1% Dye Solution					
Original	670	760	1060	930	1300
After 1st Wash Test	47	56	66	64	77
After 2nd Wash Test	39	47	56	52	61
1.5% Dye Solution					
Original	800	1150	1200	1525	1330
After 1st Wash Test	65	70	74	74	72
After 2nd Wash Test	57	57	62	62	63
WITHOUT ACID—NOT HEAT SET					
0.25% Dye Solution					
Original	42	71	154	154	149
After 1st Wash Test	48	45	43	83	81
After 2nd Wash Test	41	36	33	60	70
0.5% Dye Solution					
Original	105	102	151	275	288
After 1st Wash Test	47	63	63	74	78
After 2nd Wash Test	40	47	50	59	62
1% Dye Solution					
Original	157	200	260	460	450
After 1st Wash Test	48	43	52	67	80
After 2nd Wash Test	38	33	39	53	67
1.5% Dye Solution					
Original	345	385	630	825	940
After 1st Wash Test	53	63	65	73	73
After 2nd Wash Test	42	42	50	60	57
WITHOUT ACID—HEAT SET					
0.25% Dye Solution					
Original	39	67	106	125	168
After 1st Wash Test	91	88	84	88	104
After 2nd Wash Test	91	78	73	87	86
0.5% Dye Solution					
Original	90	105	144	220	206
After 1st Wash Test	79	87	88	88	89
After 2nd Wash Test	81	79	89	86	80
1% Dye Solution					
Original	138	178	248	420	390
After 1st Wash Test	86	78	81	83	92
After 2nd Wash Test	73	67	73	71	88
1.5% Dye Solution					
Original	410	540	660	800	930
After 1st Wash Test	82	85	87	86	90
After 2nd Wash Test	73	73	77	75	79

PLANT TRIAL NO. 7———

Nylon oxford fabric, O.D. 7

16 lb. Neutracyl Yellow N
8 lb. Neutracyl Blue G

50 gal.
Time in steamer (sec.)..... 90
Temperature of steamer, °F..... 224
Temperature of dye in padder, °F..... 136

A nylon oxford construction is similar to a taffeta weave in many respects. Therefore, the top roll of the padder was lapped with cloth to reduce the pickup of solution. The pickup on the run was computed to be 21.3 per cent. The dyed fabric showed no warp streaks or barré effect. The light test was satisfactory at 40 Fade-Ometer hours. The wash fastness was poor, but was improved by subsequent heat setting.

PLANT TRIAL NO. 8———In another plant the following trials were completed:

a. 1% Xylene Light Yellow 2G
   2% formic acid, 85%
b. 1% Neolan Orange R
   2% formic acid, 85%

The nylon fabric in each instance was padded, steamed 14 seconds, rinsed with cold water and dried.

Both of these plant trials were successful. The general appearance was excellent. The wash fastness of the yellow was excellent without treatment. The orange wash fastness was only fair. Heat treatment at 400°F. for 30 seconds improved the wash fastness considerably.

DISCUSSION OF RESULTS

Many acid and direct dyes diffuse rapidly into nylon fibers when padded and steamed 10 to 15 seconds. Some of the dyes are also fixed, as shown by wash-fastness tests. Others are only partially fixed, and some are only absorbed and require a further treatment to form a firm chemical bond. Unpublished results by the du Pont Company, made available to this Committee, showed that acetate dyes can be dyed by a continuous padding and steaming process in two minutes, indicating that absorption is very rapid. Acetate dyes were not studied because of their low wash fastness. Sorption with no surface precipitation was indicated by the excellent crocking fastness of all wet pad-steam dyeings of acid colors. There was no migration of dye observed in after-drying. The mechanism of sorption as opposed to chemical bonding is unknown. Possibly it might be similar to that of dyeing with acetate dyes, or it may be similar to that observed by Peters *(8)*, where, after the chemical salt linkages have been completed, and with high acid concentration, greater quantities of the dyes are absorbed but not held firmly.

The suggestion is made that the mechanism of dyeing of acid-type dyes takes place in two stages. First, the absorption of the dyes as single molecules or ions or, more probably, as dye aggregates. The second stage takes place when the dye molecules diffuse further into the fiber and chemical bonding takes place. If a dye aggregate is absorbed, rather than single molecules, longer steaming time allows the aggregate to be reduced to single molecules or ions and combine with the end amino groups of the nylon polymer.

TABLE XIe

ALIZARINE CYANINE GREEN, C.I. 1078

STEAMING TIME	*15 sec.*	*30 sec.*	*1 min.*	*5 min.*	*15 min.*
WITH ACID—NOT HEAT SET					
0.25% Dye Solution					
Original	100	98	96	99	103
After 1st Wash Test	55	48	52	69	84
After 2nd Wash Test	39	37	44	61	74
0.5% Dye Solution					
Original	188	182	172	173	181
After 1st Wash Test	51	52	65	74	79
After 2nd Wash Test	40	42	51	65	68
1% Dye Solution					
Original	236	320	338	355	450
After 1st Wash Test	51	62	64	69	73
After 2nd Wash Test	40	51	53	57	58
1.5% Dye Solution					
Original	360	370	381	480	440
After 1st Wash Test	59	63	69	76	80
After 2nd Wash Test	51	51	53	64	63
WITHOUT ACID—NOT HEAT SET					
0.25% Dye Solution					
Original	56	78	88	95	94
After 1st Wash Test	37	48	57	75	84
After 2nd Wash Test	27	37	45	63	72
0.5% Dye Solution					
Original	64	89	92	157	158
After 1st Wash Test	36	46	48	72	85
After 2nd Wash Test	25	35	35	57	72
1% Dye Solution					
Original	114	159	179	271	358
After 1st Wash Test	44	53	54	76	80
After 2nd Wash Test	33	42	55	76	67
1.5% Dye Solution					
Original	140	182	239	430	510
After 1st Wash Test	37	44	48	63	76
After 2nd Wash Test	26	34	35	57	65
WITHOUT ACID—HEAT SET					
0.25% Dye Solution					
Original	45	67	79	80	87
After 1st Wash Test	77	81	85	90	94
After 2nd Wash Test	65	68	73	79	87
0.5% Dye Solution					
Original	66	89	104	140	139
After 1st Wash Test	78	74	74	79	94
After 2nd Wash Test	66	61	61	67	86
1% Dye Solution					
Original	119	176	165	267	330
After 1st Wash Test	66	80	83	87	90
After 2nd Wash Test	53	68	67	71	76
1.5% Dye Solution					
Original	148	230	280	420	610
After 1st Wash Test	70	69	71	76	86
After 2nd Wash Test	57	56	58	64	72

TABLE XIf

ALIZARINE FAST LIGHT BLUE C

STEAMING TIME	*15 sec.*	*30 sec.*	*1 min.*	*5 min.*	*15 min.*
WITH ACID—NOT HEAT SET					
0.25% Dye Solution					
Original	100	88	99	99	98
After 1st Wash Test	48	58	62	70	76
After 2nd Wash Test	35	43	45	57	62
0.5% Dye Solution					
Original	153	127	159	154	168
After 1st Wash Test	52	62	65	77	76
After 2nd Wash Test	37	47	51	65	63

TABLE XIg

ALIZARINE SUPRA BLUE A, Pr. 12

STEAMING TIME	15 sec.	30 sec.	1 min.	5 min.	15 min.
WITH ACID—NOT HEAT SET					
0.25% Dye Solution					
Original	100	100	100	96	117
After 1st Wash Test	52	56	55	63	62
After 2nd Wash Test	33	35	35	47	51
0.5% Dye Solution					
Original	146	138	139	140	138
After 1st Wash Test	51	53	62	63	63
After 2nd Wash Test	31	33	40	43	43
1% Dye Solution					
Original	222	231	215	261	233
After 1st Wash Test	53	59	57	58	61
After 2nd Wash Test	32	35	35	34	39
1.5% Dye Solution					
Original	275	305	340	353	356
After 1st Wash Test	57	57	56	59	59
After 2nd Wash Test	38	35	37	38	37
WITH ACID—HEAT SET					
Original	98	98	93	100	112
After 1st Wash Test	67	60	60	67	59
After 2nd Wash Test	49	42	44	45	41
0.25% Dye Solution					
0.5% Dye Solution					
Original	153	139	137	143	136
After 1st Wash Test	57	62	70	64	63
After 2nd Wash Test	41	43	47	47	46
1% Dye Solution					
Original	214	220	215	258	229
After 1st Wash Test	58	60	65	57	63
After 2nd Wash Test	41	41	46	38	43
1.5% Dye Solution					
Original	289	336	336	333	336
After 1st Wash Test	67	57	58	63	62
After 2nd Wash Test	48	37	44	40	41
WITHOUT ACID—NOT HEAT SET					
0.25% Dye Solution					
Original	67	66	66	72	74
After 1st Wash Test	37	39	39	52	61
After 2nd Wash Test	24	25	26	35	47
0.5% Dye Solution					
Original	115	113	121	133	137
After 1st Wash Test	37	42	42	51	61
After 2nd Wash Test	23	26	27	35	41
1% Dye Solution					
Original	187	262	315	335	333
After 1st Wash Test	42	45	47	55	56
After 2nd Wash Test	27	34	32	35	39
1.5% Dye Solution					
Original	121	275	292	349	370
After 1st Wash Test	39	43	50	53	55
After 2nd Wash Test	24	26	31	35	35
WITHOUT ACID—HEAT SET					
0.25% Dye Solution					
Original	79	70	68	66	70
After 1st Wash Test	51	52	53	61	62
After 2nd Wash Test	37	39	40	50	50
0.5% Dye Solution					
Original	139	125	130	118	131
After 1st Wash Test	50	50	50	62	63
After 2nd Wash Test	35	36	36	47	47
1% Dye Solution					
Original	176	266	317	342	352
After 1st Wash Test	48	46	49	53	50
After 2nd Wash Test	34	32	36	39	36
1.5% Dye Solution					
Original	139	331	342	345	385
After 1st Wash Test	52	47	47	57	56
After 2nd Wash Test	38	16	35	39	39

Under heat-setting conditions, where the fiber becomes plastic, a similar reaction possibly takes place. There is evidence for such a theory of absorption because there is no noticeable warpiness on most of the pad-steam dyeings that have been made, even when only a portion of the dye is fixed and the remainder washes out. In many instances an increased color depth has been observed by heat setting or resteaming, even though the dyed material was thoroughly rinsed or allowed to remain in cold water for 24 hours. Evidence of crocking was not observed in these tests. The increased color value, as shown in Tables IX and X, indicated an initial dye absorption as an aggregate which diffuses into the fiber and forms salt linkages during the after treatments. It has been shown by the Rhode Island Section *(17)* that dye aggregates in the fiber will show less color value than a fine dispersion. Both processes of absorption and chemical bonding probably take place simultaneously. In back of jig dyeing the dyeing time is relatively long and probably the salt linkages form as the dye is absorbed. The liquor ratio of cloth to dye solution is also high. In the wet-pad-steam dyeing, when the time of dyeing was extremely short and the ratio of cloth to dye solution was often 50 to 100 times greater than in beck or jig dyeing, absorption, either in a molecular state or as a dye aggregate, takes place first, and molecular combination was not completed until further treatments were used.

A pot dyeing of Brilliant Croceine M and a pad-steam dyeing taken from Plant Trial No. 1 were steamed 10 minutes. The pot-dyed fabric was not changed appreciably, but that from the plant trial became brighter and heavier in depth.

Blocking in the dye mixtures was not observed with the wet-pad-steam method. As explained in the section entitled "Dyeing of Compound Shades", since the time of dyeing is so short and the dye concentration is relatively high, diffusion of a mixture of dyes possibly takes place producing the expected shade. The same mixture of dyes dyed by the jig or beck method might show considerable blocking. The condition of padding mixtures has been observed which resulted in the expected shade, but which on a No. 3 wash test showed a considerable washdown of one of the dyes. A treatment of heat setting or steaming fixed the dyes so that there was no washdown of one dye in preference to another. It must be remembered that these trials were run with dyes that showed the same wash fastness after the treatments, such as, heat setting or steaming.

The theory of two stages in the dyeing of nylon must be verified to be certain that the effect of change in depth is not optical because of a change in fiber diameter or change in index of refraction.

A possible explanation of the ability to dye heavier shades by the use of pretreatments with organic acids, and the effect of the addition of 10% Formic acid to the padder bath, is that agglomeration is produced and much larger quantities of dye are absorbed. The further treatments of heat setting or steaming promote diffusion and molecular bonding.

Photomicrographs did not show dye aggregates, probably because of the low total molecular size of the aggregation. In some instances poor penetration into the fiber was found. This condition does not necessarily indicate a lack of wash fastness. Photomicrographs of nylon fib-

TABLE XIh

NEUTRACYL BLUE G

STEAMING TIME	15 sec.	30 sec.	1 min.	5 min.	15 min.
WITH ACID—NOT HEAT SET					
0.25% Dye Solution					
Original	100	103	111	113	114
After 1st Wash Test	94	92	91	93	92
After 2nd Wash Test	91	88	86	87	90
0.5% Dye Solution					
Original	153	164	206	188	203
After 1st Wash Test	93	89	92	93	98
After 2nd Wash Test	93	84	89	92	95
1% Dye Solution					
Original	233	220	219	253	265
After 1st Wash Test	91	92	93	88	98
After 2nd Wash Test	87	87	91	92	95
1.5% Dye Solution					
Original	310	332	330	359	350
After 1st Wash Test	95	92	100	92	104
After 2nd Wash Test	92	91	89	90	99
WITH ACID—HEAT SET					
0.25% Dye Solution					
Original	98	105	110	108	108
After 1st Wash Test	96	89	91	93	96
After 2nd Wash Test	94	93	91	92	94
0.5% Dye Solution					
Original	157	161	205	184	200
After 1st Wash Test	95	96	93	95	98
After 2nd Wash Test	95	90	91	95	97
1% Dye Solution					
Original	229	221	233	233	258
After 1st Wash Test	95	96	95	97	94
After 2nd Wash Test	93	92	89	98	93
1.5% Dye Solution					
Original	316	325	350	340	365
After 1st Wash Test	95	93	92	96	95
After 2nd Wash Test	92	89	89	95	95

ers taken from Plant Trial No. 1 (1% Brilliant Croceine M) showed a ring dyeing. The wash fastness was excellent. A well penetrated dyeing of Alizarine Supra Blue A showed only fair wash fastness. Thomas and Faris *(14)* indicated that some dyes are penetrating and others are ring dyers. The penetrating dyes often have unsatisfactory wash fastness (Hager, et al., *18*). Ring-dyeing dyes can be made to penetrate the fibers by prolonged steaming or high-temperature dyeing.

The dyeings by the wet-pad-steam process did not approach the saturation value of nylon because of the light to medium shades produced. Peters *(8)* showed that in the case of Xylene Light Yellow (C.I. 639), one gram of nylon forms salt linkages with 0.05 milliequivalents of dye. This dye has a molecular weight of 551 and is dibasic. It may be assumed that the dye is approximately of 50 per cent strength (Peters showed Lissamine Fast Yellow 2G as 65 per cent). Therefore, to reach saturation a 2.5 per cent dyeing must be made. With a pickup of 25 per cent, as in padding, the dye concentration in the padding bath would have to be 10 per cent. In this investigation, 1 to 2 per cent padding solutions were used.

In practical applications, whether complete fixation takes place or not by padding and steaming, many dyes are absorbed and are held strongly enough so that further treatments can be used to improve the fixation. This has a definite advantage in that the possibility of dye migration during drying is eliminated and makes possible the treatments, consisting of heat-setting, as in the Thermosol process, or a steaming operation. When the dye is simply padded onto the cloth and dried, migration of the dye is hard to prevent. The method of pad-steam dyeing should also be of interest to printers because most printed nylons are steamed to fix the printed color. Therefore, a simple padding and steaming process, drying, printing and a steaming for fixation of the printed dye will also improve the wash fastness of the dye ground tremendously. Plant trials have been completed according to this method, and samples showing some of the practical possibilities were exhibited to the contest judges.

Several Neutracyl dyes, manufactured by du Pont, have been used. These dyes are neutral-dyeing, acid-type colors developed especially for nylon. No other information is available except that the manufacturer stated that the mechanism of the dyeing is similar to the absorption of acetate colors, involving a neutral absorption and rapid diffusion into the fiber. These dyes are a distinct type, and in this investigation many plant dyeings using the same general procedure as with acid colors have been made.

The dyeing of an O.D. #7 shade was attempted because of the interest in military fabrics. The process is described as

TABLE XII

Data showing effect of steaming time and build-up of depth of shade for dyes on which wash tests were not completed.

NEUTRACYL BLUE G

STEAMING TIME	15 sec.	30 sec.	1 min.	5 min.	15 min.
WITHOUT ACID—NOT HEAT SET					
Original					
0.25% Dye solution	101	100	98	104	109
0.5% Dye solution	155	152	140	161	164
1% Dye solution	273	229	257	279	291
1.5% Dye solution	292	301	256	349	360

ANTHRAQUINONE VIOLET, C.I. 1080

WITH ACID—NOT HEAT SET					
Original					
0.25% Dye solution	100	98	94	97	93
0.5% Dye solution	153	164	162	171	157
1% Dye solution	265	250	267	278	331
1.5% Dye Solution	275	345	305	400	430

PONTACHROME FAST GRAY L

WITH ACID—NOT HEAT SET					
Original					
0.25% Dye solution	100	103	103	116	112
0.5% Dye solution	159	153	157	184	198
1% Dye solution	212	215	212	272	315
1.5% Dye solution	231	289	285	359	365

ALIZARINE DIRECT BLUE AGG

WITH ACID—NOT HEAT SET					
Original					
0.25% Dye solution	100	103	103	109	103
0.5% Dye solution	168	175	165	175	176
1% Dye solution	240	258	285	290	292
1.5% Dye solution	362	400	400	381	455

TABLE XIII

Plant Dyeings No.	Dye	Conc., %	Yield	General Appearance	Continuously Dyed						After treatment Heat-set at 400°F.						After treatment Heat-set at 400°F. Sunlight		Re-steamed 10 Minutes
					No. 3 Wash	Staining	Fade-Ometer 10	20	30	40	No. 3 Wash	Staining	Fade-Ometer 10	20	30	40	24	40	No. 3 Wash
1	Brilliant Croceine M, with 2% of formic acid, 85%	1.0	S	E	S −6%	Slight W	SB	B	P	P	S −1%	None	SB	B		P	SB		
2a	Chlorantine Fast Yellow 5GLL	1.0	S	U	F	C-R	SB	B	F	F	S	Slight C-R	SB	SB	F	F	Heat-set at 420° F. Slightly Redder	Slightly Redder	
2b	Alizarine Supra Blue A, with 2% of formic acid, 85%	1.0	S	U	F	Slight N-W-Slk	NC	SB	F	F	F	Slight N-W-Slk	NC	SB	F	F	NC	NC	
2c	2 Chlorantine Fast Yellow 5GLL / 1 Alizarine Supra Blue A with 2% of formic acid, 85%	1.0	S	U	F	C-R	SB	B	F	F	S	None	NC	SB	F	F	SB		
												Heat-set at 420°F.							
5a	Alizarine Cyanine Green, with 2% of formic acid, 85%	1.0	S	E	P −43%			B		P	S +17%			SB		F	SB		S −7%
5b	Alizarine Supra Blue A, with 2% of formic acid, 85%	1.0	S	E	P −43%			B	F	P	F −36%			B		P	NC		F −35%
5c	Alizarine Sky Blue B, with 2% of formic acid, 85%	0.5	S	E	F −38%			B		P	S −23%			SB		F	SB		S −16%
6a	Sulphon Cyanine 5R	0.1	S	E	S	None				D	S	None				D			S
6b	Neutracyl Yellow N	0.25	S	E	F	Slight W-Slk				B	F	Slight W-Slk				B			S
6c	1 Alizarine Cyanine Green / 1 Neutracyl Blue G	0.1	S	E	F	Slight W				B	S	None				B			S
6d	Chromolan Grey G	0.25	S	F	F	None				B	S	None				B			S
												Heat-set 1 minute							
7	2 Neutracyl Yellow N / 1 Neutracyl Blue G	6.0	S	S	P	W-Slk-N				SB	S	None				SB			S
												Heat-set 30 seconds							
8a	Zylene Light Yellow, with 2% of formic acid, 85%	1.0	S	E	S	None				SB	S	None							
8b	Neolan Orange R, with 2% of formic acid, 85%	1.0	S	E	P	Slk				SB									

E = Excellent
S = Satisfactory
F = Fair
P = Poor
B = Break
SB = Slight Break
D = Destroyed

U = Uneven
NC = No Change
C = Cotton
N = Nylon
R = Rayon
Slk = Silk
W = Wool

Plant Trial No. 7 and the results were shown in the section on "Plant Dyeings". This shade is somewhat heavier than many of the dyeings made, and consequently more plant work will have to be done to prove the practicability of this method. However, the fastness properties and general appearance characteristics are excellent when aftertreatments are used.

Two nylon shirts of high quality were purchased and tests indicated that they were dyed with acetate colors. Following the manufacturer's instructions for washing, approximately 75 per cent of the dye had washed out after 10 washes (one garment in a Westinghouse Launderomat with the temperature kept at 140°F.). The manufacturer's hang tag indicated that the shirt could be washed in a household automatic laundry machine. Normal household water temperatures are frequently higher than 140°F. Samples of similar materials, dyed by the pad steam method and aftertreated, showed very little loss in depth of shade after washing the same number of times. Garments of the acetate-dyed nylon and the fabrics dyed with the acid-type dyes will be exhibited, before and after washing.

SUMMARY AND CONCLUSIONS

Heretofore it has been difficult to produce dyed nylon piece goods with satisfactory fastness properties and free from warpy or harré effects. The practical and scientific information provided by this investigation has led to the development of a method of producing satisfactory results by standard commercial operations.

This investigation has indicated the following conclusions on the dyeing of nylon piece goods:

1. Dyeing takes place in two stages: first, the absorption of the dye without chemical bonding; and second, diffusion into the fiber, allowing chemical bonding to take place.

2. These facts can be utilized in practical operation by first applying the dye solution mechanically, and then following with a steaming treatment to produce bonding.

3. The rapid steaming treatment in many cases does not completely fix the dye. However, as no migration is observed during drying, further treatment can be employed.

4. Each dye reacts differently as to the effect of dyeing assistants, steaming time and concentration of dye. Individual studies are necessary for each dyestuff.

5. Some of the "blocking effects" are eliminated by this process.

6. The proper selection of dye, dyeing assistant and steaming time, with or without heat-setting, produces commercially acceptable dyed nylon fabrics.

ACKNOWLEDGMENTS

The assistance given by the following organizations in contributing materials, technical information, services of personnel and use of laboratories and plant equipment is acknowledged with thanks and appreciation:

Apponaug Company
Arnold, Hoffman and Company, Inc.
Bradford Dyeing Association (U.S.A.)
Calco Chemical Division, American Cyanamid Company
Ciba Company, Inc.
Cranston Print Works Company
E. I. du Pont de Nemours and Company, Inc.
General Dyestuff Corporation
Glenlyon Print Works.
Kenyon Piece Dye Works, Inc.

(Concluded on Page P32)

Intersectional Contest—

A SIMPLIFIED METHOD FOR THE DETERMINATION OF THE OIL CONTENT OF TEXTILES*

NORTHERN NEW ENGLAND SECTION

Prof. John H. Skinkle

The standard method of determining the total content of oils and fats in textiles with an elaborate Soxhlet apparatus is time consuming. Various short-cut methods, which are generally considered less accurate than the Soxhlet method, have been proposed from time to time. This paper describes a quick, simple procedure for determining oil in textile materials, which is carried out with the apparatus normally present in any laboratory. The new method is as accurate as the Soxhlet method according to comparative tests made with samples of known oil content. The time required for a single determination is about thirty minutes as compared with about three hours for the old Soxhlet procedure.

The new method is not new in itself, being merely a simplified modification of known methods. The demonstration that its accuracy is at least as good as the Soxhlet method, however, is new and has been proved statistically on an adequate number of samples by several cooperating mill laboratories.

Committee

William W. Pennock, *Chairman*
Prof. John H. Skinkle, *Speaker*
Leslie Christison
Robert G. Fiddes
Edward M. Lynch, Jr.

INTRODUCTION

OILS and fats play a critical part at many stages of textile processing, and the estimation of the amounts of oil present becomes a matter of considerable importance. The usual method for determining the oil content of textiles is extraction in a Soxhlet apparatus with a fat solvent, such as ether or carbon tetrachloride. This method is open to several objections, among which may be mentioned the following:

1. The all-glass Soxhlet apparatus required is expensive and fragile.

2. The time required to complete the test is excessive for control purposes. Usually two hours is needed for the solvent extraction alone, to which must be added time for evaporation of the solvent, drying and weighing of the extract.

3. Prolonged treatment with boiling solvent may extract substances other than fats and oils from the textile being tested and may thus lead to erroneous results.

The present study was undertaken with a view to the testing of shorter methods and comparing them with the standard test in order to find a simplified method more suitable for general use.

* Presented before Annual Meeting in Portsmouth, N. H., on Sept. 29, 1950 .

EXPERIMENTAL

PREPARATION OF SAMPLES——Five samples of worsted top containing known quantities of oil, with the oil content ranging from 0.89% to 11.1% were prepared as follows: The samples were first freed from oil by extraction in the Soxhlet apparatus with carbon tetrachloride. They were then dried to determine the oven-dry oil-free weight. The samples were next treated with ether solutions of an oil mixture (50% mineral oil, 50% lard oil) in such a manner as to insure even impregnation with the oil. After removal of ether by air drying the samples were again oven-dried. The gain in weight, figured as a percent of the final oven-dry weight, was recorded as the true oil content of the sample.

COMPARATIVE TESTS——In the first series of tests the Soxhlet method was carried out as follows: A 5-gram sample (oven-dry basis) of wool top was placed in the Soxhlet extractor with carbon tetrachloride. The solvent was boiled until it had siphoned 15 times. After excess solvent had been distilled off, the flask was dried to constant weight. The sample of

TABLE I

Sample Number	1	2	3	4	5	Ave. %
True % oil	0.89%	1.80%	2.93%	3.34%	11.1%	of true value
Soxhlet method by gain in weight of flask						
Average	0.92	2.14	2.61	2.78	16.4	
Spread	.11	.12	.04	.88	1.4	12.
Error	.03	.34	.32	.56	5.3	20.
Soxhlet method by loss in weight of sample						
Average	0.82	2.09	2.94	2.91	14.5	
Spread	.02	.06	.10	.93	1.3	10.
Error	.07	.29	.01	.43	3.4	14.
Aliquot method						
Average	0.85	1.49	2.90	3.25	11.6	
Spread	.02	.40	.01	.00	.5	6.
Error	.04	.31	.03	.09	.5	5.
Nonionic scouring method						
Average	0.92	3.07	3.12	3.30	5.8	
Spread	.01	.05	.03	.32	1.5	6.
Error	.03	1.27	.19	.04	5.3	26.

TABLE II

INTERLABORATORY CHECKS ON ALIQUOT METHOD

Sample		Lab 1	Lab 2	Lab 3	Lab 4
Rayon cloth	1	1.2	1.3	1.5	1.0
	2	1.2	1.3	1.5	0.8
	3	1.3	1.0	1.4	0.8
	4	1.4	1.1	1.2	0.8
	5	1.0	1.0	1.2	0.8
	Ave.	1.22	1.14	1.36	0.90
		F = 3.81			
		Grand Average = 1.15			
Worsted top	1	0.9	1.4	1.4	0.9
	2	0.9	1.6	1.4	1.3
	3	1.0	1.0	1.6	1.2
	4	1.0	1.3	1.6	1.4
	5	1.1	1.2	1.6	1.3
	Ave.	0.98	1.30	1.52	1.22
		F = 3.24			
		Grand Average = 1.26			
Rayon cloth	1	2.4	2.3	1.9	1.7
	2	2.1	2.4	2.5	1.7
	3	2.4	1.9	2.6	1.6
	4	2.4	2.3	2.0	1.6
	5	2.2	2.3	2.4	1.6
	Ave.	2.30	2.24	2.28	1.64
		F = 3.86			
		Grand Average = 2.12			
Worsted top	1	2.8	3.0	3.4	3.0
	2	3.0	3.2	3.2	3.1
	3	3.2	2.8	3.1	2.6
	4	2.9	3.1	3.4	2.9
	5	3.0	3.0	3.2	3.3
	Ave.	2.98	3.02	3.26	2.98
		F = 0.61			
		Grand Average = 3.06			

top was removed from the extractor and, after evaporation of solvent by air drying, oven-dried to constant weight. The percent of oil was calculated by two methods: (1) by loss of weight of the sample, (2) by gain in weight of the extractor flask.

Two simplified methods were carried out on the same samples as follows:

ALIQUOT METHOD——

APPARATUS

1 250-ml. beaker
1 100-ml. beaker
1 50-ml. beaker
1 50-ml. graduate
1 25-ml. graduate
1 hot plate (alternatively, steam bath or infrared lamp)
1 centigram balance (alternatively, grain scale)

Procedure: Weigh out a 10 gram sample to be extracted at room conditions on the centigram balance.

Dry the 100-ml. beaker by placing it on the clean hot plate (low setting) for 3 to 4 minutes. Cool briefly and weigh on the centigram balance. Repeat the procedure until the weight is constant.

Place the sample in the 250-ml. beaker. Add 50 ml. of carbon tetrachloride carefully measured from the 50-ml. graduate. Work the sample in the beaker for 3 to 4 minutes, forcing the solvent repeatedly through the sample with the base of the 50-ml. graduate as a plunger.

Remove 25-ml. of the solvent as follows: Hold the beaker containing the sample and solvent in an inclined position over a 50-ml. beaker. Press the sample firmly with the plunger until 25-ml. or more of the solvent has drained off. Carefully measure 25-ml. of the solvent with the 25-ml. graduate and pour it into the previously weighed 100-ml. beaker.

Evaporate off the solvent at a low setting on the hot plate. Dry to constant weight by the same procedure as in weighing the empty beaker.

Calculate percent of oil by gain in weight of the beaker multiplied by two.

NONIONIC SCOURING METHOD——

APPARATUS AND CHEMICALS

1 1000-ml. beaker
1 50-ml. graduate
1 hand-operated wringer
1 conditioning oven equipped with centigram balance
Nonionic detergent (ethylene-oxide type)

Procedure: Prepare 500-ml. of a 0.05% solution of the nonionic detergent.

Oven-dry and weigh a 10-gram sample in the conditioning oven at 105°C.

Place the sample in the detergent solution at room temperature. Agitate for 5 minutes with the base of a 50-ml. graduate as a plunger. Rinse the sample under the tap and squeeze it between the rolls of a hand wringer.

Repeat the procedure twice more in the same scouring bath for a total of three treatments.

Dry and weigh the sample in the conditioning oven at 105°C.

Calculate percent of oil by loss in weight of the sample.

The results of duplicate tests by the above methods on five samples of oiled worsted top are given in Table I.

Table I shows the following:

1. The Soxhlet method gives more accurate results from the loss of weight of the sample than from the gain in weight of the flask. Most commercial laboratories, however, measure the gain in weight of the flask.

2. The nonionic scouring method has good reproducibility (low spread) but the error is high. Most of this error, however, is due to Sample 5, which had a very large amount of oil, Apparently a nonionic detergent removes only up to about 5% of oil completely. Up to this value, however, the nonionic detergent method is quite satisfactory.

3. All methods except the aliquot have more error than spread. This means that the true value may not be close to the average value of duplicate determinations if the error is great, even when duplicates agree closely.

4. The Aliquot method is more reproducible (less spread) and more accurate (less error) than any of the other methods, including the Soxhlet.

TABLE III

INTERLABORATORY CHECKS ON SOXHLET AND ALIQUOT METHODS WITH SPECIAL SAMPLING

Precautions

Laboratory		Soxhlet	Aliquot
A	1	3.06	2.80
	2	2.23	2.84
	3	3.11	2.84
	Ave.	2.80 ± .29	2.83 ± .01
B	1	2.79	2.92
	2	2.81	2.70
	3	2.57	2.42
	Ave.	2.72 ± .08	2.68 ± .14
C	1	2.42	2.38
	2	2.80	3.32
	3	3.46	3.34
	Ave.	2.89 ± .30	3.01 ± .32
Grand average		2.81 ± .13	2.84 ± .11
	Between laboratories	F = 1.93	
	Between methods	F = 0.86	

INTERLABORATORY TESTS OF ALIQUOT METHOD———In view of the preceding work, and the excellent showing of the aliquot method, interlaboratory trials of the method were made to determine reproducibility by different laboratories.

Samples of two worsted tops and two rayon fabrics were submitted to four cooperating laboratories. Each laboratory made five determinations on each sample. The data were then analyzed for variance by calculation of the F value. These F values are also given in Table II, and for the four samples the average F = 2.9. The F values are between the 5% and 1% significance, estimated at about 2%. This means that only twice in a hundred times will two laboratories get results which are significantly different.

INTERLABORATORY CHECKS ON SOXHLET AND ALIQUOT METHODS———As a further check on the work to insure that the reproducibility of the aliquot method is equal to that of the Soxhlet, and that variations in the sample were not unduly affecting the results, another large sample of worsted top was extracted free of oil, then carefully treated to add a commercial oil uniformly to the whole top; this was done by saturation with an ether solution of the oil as previously described. The top was then carefully sampled to eliminate variations, if any, in the oil content. Three different mill laboratories then ran three Soxhlet determinations and three aliquot determinations on the samples. The results are given in Table III.

It may be seen that in no case is there a significant difference between the two methods, and in no case is there a significant difference between two laboratories in the average results. This is also confirmed by the F values.

CONCLUSION

We have shown that a simple method, which involves no special apparatus and which is very fast to carry out, is inherently capable of as much accuracy and reproducibility as the standard Soxhlet method for the determination of the oil content of textiles. No novelty is claimed for the method, since similar methods are now in use in the industry, although they are always presented as rough approximations. What we claim and have demonstrated is that this method, when properly carried out, needs no apology, and that it is as accurate as the Soxhlet method, besides being simpler, cheaper, and faster.

Nylon Dyeing—

(Concluded from Page P29)

Lincoln Bleachery and Dye Works
National Aniline Division, Allied Chemical and Dye Corporation
Philadelphia Quartermaster Depot
Qualitex, Inc.
Rhode Island State College
Sayles Finishing Plants
J. P. Stevens and Company, Inc.
Textron, Inc.
United States Finishing Company
Verney Corporation

BIBLIOGRAPHY

(1) *Am. Dyestuff Reptr.*, 29, 646 (1940).
(2) *Calco Technical Bulletin No.* 803, "Nylon: Treatments and Dyeing Procedures", Louis Fidell.
(3) Diamond, C., *Rayon Textile Monthly* 28, No. 4, 60-62 (1947).
(4) *Rayon Textile Monthly* 28, 273-6, 323-4, 379-81 (1947).
(5) *Du Pont Technical Laboratory Bulletin* 30, Nos. 5 and 6, 109-113 (1950).
(6) Progress Report No. 2 on The Dyeing of Nylon Fabrics—O.D. 7, submitted to Dr. Arnold L. Lippert, Chief, Dye and Finishing Branch, War Production Board, August 29, 1944.
(7) *Du Pont Technical Bulletin* 5, No. 2, 82 (1949).
(8) *J. Soc. Dyers Colourists* 61, 95 (1945).
(9) *Textile Mercury and Argus*, July 14, 1950.
(10) *Du Pont Technical Bulletin* 4, No. 3, 126-7 (1948).
(11) *Du Pont Technical Bulletin* 4, No. 4, 178 (1948).
(12) *Du Pont Technical Laboratory Bulletin* 30, Nos. 5 and 6, 102-108 (1950).
(13) *Textile World* 100, No. 6, 234 (1950).
(14) *Am. Dyestuff Reptr.* 37, 21 (1948).
(15) *Loadsby, G., "Silk", J. Rayon World* 33, May 1943.
(16) *Am. Dyestuff Reptr.* 37, 166-81 (1948).
(17) *Am. Dyestuff Reptr.* 35, 3-12 (1946).
(18) *Am. Dyestuff Reptr.* 38, 24 (1949).

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Southeastern Section Report

THE Southeastern Section will hold its first meeting of the 1951 year at the Purefoy Hotel in Talladega, Alabama. The meeting will feature a symposium on the various continuous methods of vat-dyeing.

Respectfully submitted,
HERMAN A DICKERT, *Secretary*

(1951)

PERSONAL DUES PAYMENTS

Personal dues payments in October and November have now been acknowledged with membership cards. Current payments will be acknowledged promptly. Members who do not receive cards within two weeks of payment will kindly notify the Secretary, P. O. Box 28, Lowell, Massachusetts, at once.

EMPLOYMENT REGISTER

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Lowell Textile Institute, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the Secretary.

50-49

Education: Equivalent of U. S. college, with additional graduate study; including five months in U.S.A.
Experience: ten years; since 1945 as dyeing master in mill of 900 employees specializing on wool.
Age 34; married; references; citizen of Denmark seeking position in North America, preferably southwest U.S.A.

12-25, 1-8

50-50

Education: Prague Institute of Technology, New York University.
Experience: Three years research chemist, Biochemical Inst., Prague; three years chemist in dye application laboratory, New York City.
Age 32; married; references; position as chemist or colorist, plant or laboratory, Conn. or vicinity of New York City preferred.

12-25, 1-8

50-52

Education: A.A. degree in chemistry.
Experience: Laboratory chemist and colorist, with executive responsibilities.
Age 40; married, references; position as dyer or chemist, in mill, South or West, preferred.

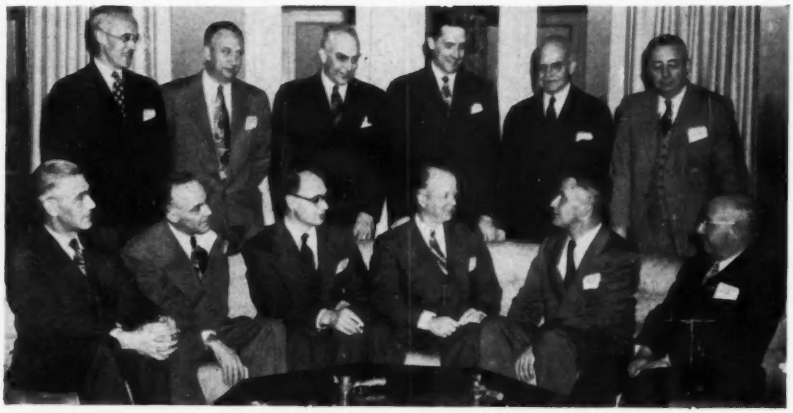
1-8, 1-22

NNE Section to Meet Jan. 26

ON January 26, the Northern New England Section, will hold its first meeting of the new season at the Hotel Commander, Harvard Square, Cambridge, Mass.

Feature of the season's opening dinner session will be an unusual presentation on the subject of detergents by Sidney M Edelstein, former research associate for the AATCC and now Technical Director for the Dexter Chemical Corporation.

NEWS



Top company and sales executives of General Dyestuff Corporation pictured at a recent sales managers' conference. Seated (left to right): Warren M. Dewing, GDC Manager, Boston, Mass.; Harold G. Shelton, General Manager, Antara Products Division; F. E. Hilger, GDC Manager, Chicago, Ill.; Dr. J. H. Bruun, Director, Central Research Laboratories; J. C. Franklin, GDC Executive Vice President; W. A. Lord, GDC Manager, Providence, R. I.

Standing: H. A. Horstmann, GDC Manager, New York; W. L. Swenson, GDC Sales Manager; Dr. Cary R. Wagner, GAF Vice President in Charge of Operations; Dr. H. B. Hass, GAF Director of Research; B. K. Archer, GDC Manager, Philadelphia, Pa.; and S. H. Williams, GDC Manager, Charlotte, N. C.

• 2 Million GAFC Expansion Program Slated for 1951

A $2,000,000 Expansion Program for increased production facilities for detergents and other surface active agents was announced by Dr Carey R Wagner, Vice President of General Aniline & Film Corporation, at a recent sales managers' conference. The new facilities are for the Grasselli, N J, and Rensselaer, N Y, plants of General Aniline. Some were recently completed and placed in operation, while others will be available in 1951. The two day meeting (Nov 30-Dec 1) started with a tour of the company's Central Research Laboratories at Easton, Pa, conferences with the research staff there and a sales meeting the following day at the offices of General Dyestuff Corporation, 435 Hudson Street, New York.

The conference was called to acquaint sales managers with the chemical products, including detergents, wetting agents, emulsifiers and other surface active agents now sold through the Antara Products Division of General Dyestuff Corporation. Antara, a former division of General Aniline, was recently merged with General Dyestuff through which General Aniline dyes and textile auxiliaries have been sold.

• New ACC Chicago Site in Construction

American Cyanamid Company has announced that J Emil Anderson & Son, Inc has started construction of a 100,000 square foot building in Chicago's Addison-Kimball District, which will be leased by the Kimad Building Corporation to ACC. The building reportedly will contain 80,000 square feet of warehouse space on the first floor and 20,000 square feet of air-conditioned offices on the second floor. Additional land at the site affords an expansion potential should it be required at a later date. Total term rental will reportedly approximate $1 million. Completion is set for March, 1951. J J Harrington and Company served as brokers.

At present, the Cyanamid organization occupies office and warehouse space at a number of locations in Chicago. The main purpose to be achieved is the consolidation of these facilities so that the several divisions of the Company may better serve Chicago and Midwestern customers. It will enable Cyanamid to meet the varied requirements of all its Divisions for office space, laboratories, blending rooms, warehouse facilities, and loading docks.

The basic construction of the proposed building will be brick and steel girder with face brick and Indiana limestone trim for the entire office and front of the warehouse, and common brick on the sides of the warehouse. Air conditioning will be provided for the office area, as well as in the laboratories and certain storage areas. The site of the building is six miles northwest of the Loop near the corner of Addison and Kimball Streets. The building will be served by switchtrack.

Among the units of the Company which will use the new facilities are Calco Chemical Division's Dyestuffs Department, Pigment Department and Bulk Pharmaceutical Department; The Industrial Chemicals Division, The Agricultural Chemicals Division, The Plastics and Resins Division, The Explosives Department and Lederle Laboratories Division's branch office, local sales office, and Animal Nutrition Department.

• Tennessee Eastman Dissolves as Corporation to Become Eastman Kodak Division

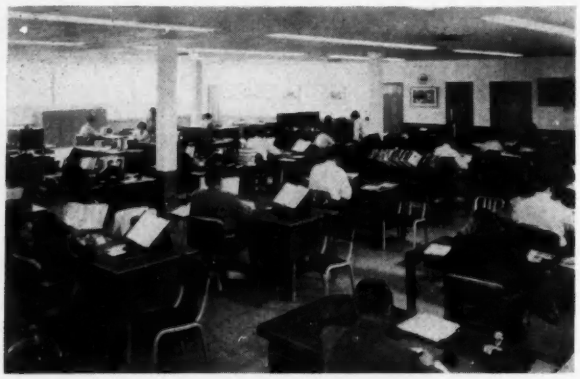
Tennessee Eastman Corporation, a wholly-owned subsidiary of Eastman Kodak Company, has been dissolved as a separate corporation effective January 1, 1951, and its business and activities in Tennessee and Texas will be conducted as divisions of the parent company.

Thomas J Hargrave, Kodak president, and James C White, Tennessee Eastman Corporation president, have announced that the Tennessee division will be known as Tennessee Eastman Company, Division of Eastman Kodak Company. The Texas division will be known as Texas Eastman Company, Division of Eastman Kodak Company.

These divisions will continue the same activities at Kingsport, Tennessee, and Longview, Texas, respectively, with no change in personnel or policies. A M Tenney Associates, Inc, will continue as sales representatives for Eastman fibers.

• Michigan Alkali Moves Cincinnati Office

Wyandotte Chemicals Corporation, Michigan Alkali Division, has moved its Cincinnati office to 825 Dixie Terminal Building, Cincinnati 2, Ohio.



Business Office of New Fisher Distribution Plant in Washington

• Fisher Scientific Plant Opening

Fisher Scientific Company, manufacturers and distributors of scientific instruments and apparatus, has opened a new plant at 7722 Woodbury Drive, Washington, D C, to serve as a stocking, shipping and repair center for the Atlantic Seaboard area. The plant serves as an advance supply base to distribute from stocks in Pittsburgh, St Louis, New York and Montreal.

Over an acre of shelving is available in the new 50,000 square foot, air-conditioned plant to store laboratory apparatus items, instruments and chemicals. Some 4,400 feet of fluorescent lighting is used and ten trunk lines, teletype and Western Union teleprinter are on hand.

Repair service and demonstration facilities and personnel are on hand to assist in the selection and repair of all Fisher instruments and those of Beckman Instruments, Inc and others. A large stock of parts for use in repair is maintained as is a Demonstration Laboratory for the use of laboratory personnel in the area who wish to examine instruments and equipment under actual use.

• Permanent Rayon Labeling Proposed

Permanent labeling of rayon fabrics to show how they should be cleaned (thus assuring long life for the articles) was proposed by Dr Jules Labarthe Jr of the Mellon Institute in an address to the Akron Section of the American Chemical Society last month at the University Club.

Discussing the work of laboratories which test fabric durability and the stability of dyes for manufacturers and stores, Dr Labarthe recommended that greater attention be paid to the chemicals used in keeping customers' garments in good condition. Soaps, synthetic detergents, and the mechanical appliances with which the customer washes, dries and irons her fabrics all should be considered by the chemists charged with testing the materials' quality, Dr Labarthe said.

Standard methods of chemical analysis and standard testing procedures should be followed where they are available, he said, and if there are no standard methods they should be developed through research.

One of the most important current projects in this field is the list of rayon standards on which the American Standards Association is working, Dr Labarthe declared, explaining that the object is to set up standard test methods for the evaluation of rayon fabrics for many end-use items in consumer goods and to set up standards of quality for some sixty different articles of men's, women's, and children's wear, as well as household fabrics containing more than 50 per cent rayon.

• '48 Output of Synthetic Organic Chemicals Lower Than in '49

The United States Tariff Commission, in their annual report on the production and sales of synthetic organic chemicals and their raw materials, reports a lower output in 1949 than in the record year of 1948. Combined production of intermediates and finished synthetic organic chemicals in that year, the Commission reports, amounted to 17.5 billion pounds, 1 billion less than was reported for 1948. Sales in 1949 of these chemicals by the producers amounted to 9.1 billion pounds, valued at 2.1 billion dollars, nearly half of the output being used to manufacture more advanced products. The output of tar and tar crudes together with crudes from petroleum and natural gas—the products from which intermediates and finished products are made—amounted to 22.5 billion pounds, slightly below the output reported for 1948.

• Harrelson Cites N. C. State Service Increase at Alumni Conclave

An observation that "facilities recently added to the School of Textiles at North Carolina State College will enable the school to increase its services to the State and region" was made by Chancellor J W Harrelson of State College and Dean Malcolm E Campbell of the College's School of Textiles, both of whom spoke at the opening session of a two-day alumni conclave at the college.

Chancellor Harrelson told more than 200 delegates attending the conclave that the expanded physical plant made possible at the School of Textiles by General Assembly appropriations is now "the greatest textile laboratory in the United States and perhaps in the world."

Other speakers at the opening session conclave included: Prof E B Grover, head of the Yarn Manufacturing Department, Prof Henry A Rutherford, head of the Department of Chemistry and Dyeing in the College's School of Textiles; C M Asbill, Jr, professor of textile machine design and development; Joe Cobb of Rhodhiss, N C, general superintendent of the Rhodhiss Division of Pacific Mills; Dent Mangum of Washington, D C, an official of the National Cotton Council; and G H Dunlap, textile consultant and director of the Placement Bureau in the School of Textiles.

W E Debnam of Raleigh, author and radio commentator, addressed an informal dinner session in the Carolina Hotel.

The final program featured as speakers Controller W D Carmichael, Jr of the Consolidated University of North Carolina and Prof J F Bogdan, head of the school's Research Department.

• NYRMA Convention Set for April

The New York Raincoat Manufacturer's Association, according to President Simon Cohen, will hold a three day exhibitor's convention at the Hotel New Yorker, New York, on April 7-8-9, 1951.

Suppliers serving the water repellant garment manufacturers will be invited to participate.

The Convention Committee consists of the following: Herman Rennert, Alvin Rainwear Co; Milton Kaufman, Aquatogs, Inc; Abraham Bookspan, Bookspan Bros Corp; Simon Cohen, Simon Cohen & Co, Inc; Samuel Greenblatt, Debby Jr Coat & Suit Co; Leon Greenberg, Irving Raincoat Co, Inc; Henry Milner, Milangor Co; Charles Plottel, Plottel Bros, Inc; Joseph Asch, Quality Coat Co; Jack Rosenstein, Rainshedder Co, Inc; and Sam Sherman, Sherman Bros, Inc.

• TRI Research Refresher Course

An extension of Textile Research Institute's educational program to be known as the Research Refresher Course has been formed. For some time it has been realized that there is a definite need for a program which can provide additional research training for applied scientists of the textile industry. In an effort to meet this need, the Institute has set up the Research Refresher Course which has the primary objectives: (1) To provide opportunities for technical men in the textile industry to work in the Textile Research Institute Laboratories for one year in order to gain an insight into modern fundamental research in textiles, (2) To provide a service to member mills wherein the training of their junior technical men may be broadened, and (3) To bring into the Textile Research Institute research group men with practical textile background which should exert a balancing effect upon the research program.

In brief, the Research Refresher program permits a limited number of technical men from member mills to work in the Textile Research Institute Laboratories under the direction of senior staff members. Salaries of these men, plus living allotments, will be provided by the firms where they are regularly employed. When desired, these men may be enrolled as "incidental graduate students" of Princeton University which permits taking one graduate course but does not lead to a Princeton degree. Candidates will be selected on the basis of academic records and industrial experience. The minimum standard is a bachelor's degree from a recognized college, university or textile school. Not more than four candidates will be accepted for enrollment, beginning with the second term of the present academic year. Inquiries about the Research Refresher program may be directed to Dr J K Dillon at the Institute's Princeton address.

• Foster D. Snell de Mexico Formed

Foster D Snell de Mexico, S de RL of Apartado 20.609, Mexico City, has been formed, according to Foster Dee Snell of the corresponding American firm of consulting chemists. It is expected that the new firm will confine its activities to consulting, development, and engineering problems in Central America, particularly in Mexico. It is reported that J Carner and J Sperling, in charge of the new subsidiary in Mexico City, will be available for consultation but it is anticipated that for the present laboratory and engineering facilities at New York City and Bainbridge, N Y will be sufficient.

Pictured above are six key figures who were in attendance at a recent meeting, held at the Waldorf, of the American Committee of Sponsors of the Lille, France Textile Exhibition.

Seated (l. to r.)—Fred Richter, General Foods Corp., representing the ECA; Sylvan Cotschal, Vice Chairman of the Committee; Henry E. Stehli, Chairman of the Committee; Maurice Charlois, Commercial Attaché, French Embassy; George D. Boinet, General Representative, International Textile Exhibition.

Standing—Julian Rozendaal, Exhibition Technical Advisor (U. S.).

• Lille Exhibition Plans Developing Well

European rearmament will probably stimulate rather than dampen the enthusiasm for American representation in the mammoth Lille Textile Exhibition scheduled for April and May, 1951, it is reported. Final space allotments have been made with representation of more than fourteen nations assured.

Every phase of the textile industry will be exhibited from the growers of cotton and producers of silk, wool, and all synthetic fiber, to the ultimate finished garments and underwear, including chemicals and the fur industry. The textile machinery will be exhibited in a special hall and twelve of the most prominent American manufacturers have sent their acceptances. The French Haute Couturier will be brilliantly represented. There will be an international bookshop of all kinds of publications and directories and a museum of modern and ancient textiles.

The huge Exposition Park of Lille will be the site of the exhibition where permanent buildings damaged during the war are being restored in very modern style. There will be a 40,000 square foot hall —"The Palace of Nations"—where the American Exhibit will be represented.

Meanwhile, plans for an international textile research conference to run concurrently with the opening have been made known by Robert Delerive, president of the French Textile Institute.

Invitations to the conference which will be held within the fair have been sent to textile centers all over the world—excluding Russia and the Iron Curtain countries.

This project was made known by Mr Delerive at the inauguration of the French Textile Institute in the presence of Andre Guillant, French secretary of state for industry and commerce and leading manufacturers in all branches of the French textile industry.

• Delta Finishing to Use G-E Range Drives

Electric drive equipment for textile ranges and other finishing machinery will be furnished by General Electric for the new million dollar finishing plant being built by the Delta Finishing Company, a Division of J P Stevens and Company, Kollocks, South Carolina. Built primarily for the wet-finishing and dyeing of rayon, the new South Carolina plant will cover more than 200,000 sq ft of floor space.

Twelve textile range drives are being installed which reportedly will be flexible enough to meet the speed range requirements of a wide variety of cloth types and weights. These drives, it is stated, will provide a 4 to 1 speed range with the over-all speed easily controlled from one or more central locations convenient to the operator.

Two motor control centers will also be installed. One control is for the filter plant and the other for the boiler room.

All the auxiliary electrical equipment will be furnished including a-c motors and controls for fans and blowers throughout the plant and for air conditioning pumps. Power distribution and metering will be handled by G-E indoor switchgear.

• PTI Golden Anniversary Banquet

The 50th Anniversary Banquet of the Philadelphia Textile Institute Alumni Association will be held at the Warwick Hotel, Philadelphia, Pa on January 26 at 7:00 PM. A cocktail hour with music will precede the banquet at 6.

Harry Pope, outstanding humorist at the affair last year, will be on hand again to give "A Lifetime of Ideas."

• Fabric Research Opens Paper Division

A new paper division which will offer research services similar to those the firm performs for the textile, plastics and chemical industries, has been opened by Fabric Research Laboratories, Inc., 665 Boylston Street, Boston. Dr Geoffrey Broughton, head of the Paper Engineering Department of Lowell Textile Institute will have charge of the new division.

In making the announcement of Dr Broughton's affiliation with the firm, Dr Walter J Hamburger, director of Fabric Research Laboratories, said that the Laboratories have installed a modern, completely equipped pulp and paper laboratory, which will be coordinated with existing facilities for chemical, physical and microscopical research.

• Dr. Mack Lauds AVC Fellowship

Dr Pauline B Mack has lauded the American Viscose Fellowship at the Ellen H Richards Institute of The Pennsylvania State College as instrumental in training a number of young people for leadership in the textile field. The fellowship was established in October, 1942.

Among those who have carried on research for the doctorate under this fellowship are Dr Suzanne Davison, assistant head of the Division of Textiles and Clothing of the Department of Agriculture's Bureau of Human Nutrition and Home Economics; Dr Virginia Jones, head of textiles and textile chemistry at the University of California; Dr Mildred H Jordan, dean of home economics at Maryland State College, Princess Anne, Md; Dr Pauline Keeney, professor of textiles at the North Carolina College for Women, Greensboro, N C; Dr Dorothy S Lyle, National Association of Dyers and Cleaners, Silver Spring, Md; the late Dr Frances Karr Ray, who was on the institute's staff; Dr Jane Werden, in charge of textiles at Cornell University, Ithaca, N Y, and Dr Margaret Zook, who initiated work in textiles and textile chemistry at the University of California at Los Angeles and is now associate professor of clothing and textiles in the School of Home Economics at The Pennsylvania State College.

George S Wham, Jr, a present fellow who will receive his PhD degree in June, is on leave from the U S Bureau of Human Nutrition and Home Economics for this study.

Other American Viscose Fellows, who have received their masters degrees, are engaged in teaching and in further research toward their doctorates.

• L. & N. Increases Space by 28%

Acquisition of approximately 85,000 square feet of additional floor space has increased Leeds & Northrup Company's Philadelphia floor space by 28%, to a total of nearly 10 acres, according to C S Redding, president.

The added space, in two parcels, is a 3-story, 50,000 square foot building at Castor and Sedgley Avenues and a 35,000 square foot structure at Collum and Rubicam Streets, Germantown.

It is reported that some operations will be transferred to the new location, but the principal manufacturing and other activities of the firm will continue to be centered at the main plant at 4901 Stenton Ave.

• SMC to Open Greenville Branch

The Sjöström Machine Company (Lawrence, Mass) will open a manufacturing branch and sales office in Greenville, S C the early part of this year. Land on the outskirts of the city has been purchased and a one-story, 50′ x 100′ building, together with an office extension will be erected. Plans call for employing approximately 20 persons with an annual payroll of $60,000.

The 78 year old company manufactures textile specialties and folding and cutting machines.

• MCA Elects Frederick, McKeen to Directorate

The Manufacturing Chemists Association, Inc, in a special meeting held at the Union Club in New York, has elected Dr D S Frederick, vice-president of Rohm & Haas Company of Philadelphia, to a newly created directorship. Dr Frederick is a former president of the Plastic Materials Manufacturers Association, and is chairman of the MCA's plastics committee.

John E McKeen, president of Charles Pfizer & Co of New York, also was elected to the directorate, succeeding the late John L Smith.

• Cotton Research Clinic, Feb. 7-9

To step up cotton research for both civilian and military uses, the Nation's top textile scientists will gather in Pinehurst, N C February 7-9, 1951 for the second Cotton Research Clinic sponsored by the National Cotton Council. M Earl Heard, Vice-President and Director of Research of West Point Manufacturing Company, will head a ten-man advisory committee to set final plans for the cotton industry's second cooperative research conference.

Held for the first time last year in Washington, D C, the Clinic is being convened again at the request of both industry and government representatives. It was found that the 1950 meeting, attended by more than 50 leading technologists, led to significant improvement in many cotton studies and brought out valuable new ideas for application of certain research findings.

The Clinic Advisory Committee, in addition to Mr Heard, includes the following: Dr Hugh Brown, Dean of Textiles, Clemson College; J B Goldberg, Director of Research, J P Stevens Co; Dr Milton Harris, President, Harris Research Laboratories; V B Holland, Director of Research, Canno Mills; Walter Regnery, President, Joanna Cotton Mills Co; Dr Walter M Scott, Ass't Chief, Bureau of Agricultural and Industrial Chemistry, USDA; Dr R Y Winters, Asst Administrator, Agricultural Research Administration, USDA; and Dr Smith and George Buck of the National Cotton Council.

• Gen. Eichelberger Highlights SOCMA December Meeting

General Robert L Eichelberger, who commanded the Eighth Army from the New Guinea campaigns through the occupation of Japan until 1948, was the dinner speaker at the December annual meeting of the Synthetic Organic Chemical Manufacturers Association. His subject was "A New Foreign Policy in Asia."

• Bersworth Appoints Tanner as Southern Agent

The Bersworth Chemical Company of Framingham, Mass, sole manufacturer of the "Versenes" has announced the appointment of the Chas S Tanner Co as their agent in the states of Virginia, North Carolina, South Carolina, Georgia, Alabama and Tennessee.

The Chas A Tanner Co is represented in the South by Karl H Inderfurth, Box 6161, Charlotte 7, N C.

• H-D Executive Completes Mayan Expedition

Nelson S Knaggs, vice-president in charge of sales of the Hilton-Davis Chemical Company Division, Sterling Drug Inc, has completed a month-long airplane photographic exploration expedition to Yucatan, Mexico, and Central America. He was accompanied by his son, Nelson S Jr, 20, a third-year student at the University of Cincinnati, and Frederick Kock, Cincinnati artist and architect.

Chief purpose of the expedition, which bore the flags of the Explorers Club of New York and the Museum of Natural History, Cincinnati, was to explore and photograph by motion picture and still camera, the five major metropolises of the ancient Mayan civilization. Mr Kock rendered paintings and architectural drawings of the ruins visited, while Mr Knaggs did a photographic and archaeological study of the ruins.

This was the fourth expedition in which Mr Knaggs has participated.

• CCNY Group Visits United Piece Dye

A visit to the dyeing and printing plant of the United Piece Dye Works, Lodi, N J by the Applied Textile Exporting class of the CCNY School of Business was arranged by Leon B Rosenblatt, instructor, and Herman Baumann, research director of the plant on Dec 16, marking the first time in the history of the school that a class visited a textile plant in full operation. The tour through the greige room and dye house was highlighted by visits to the color shop, engraving room and print shop.

The students are all employed in some phase of textile exporting and this tour showed the various processes that greige goods must go through before they are ready for resale abroad.

• American Section, Societe de Chimie Industrielle Revived

The American Section of the Societe de Chimie Industrielle has been reconstituted with the following officers and committee:

President—Worth Wade, American Viscose Corporation

Vice Presidents—Robert S Aries, consulting chemical engineer; Jean R L Martin, Coty, Inc

Honorary Secretary—Jerome Alexander

Secretary and Treasurer — Pierre L Bouillette

Council—M T Bogert, F S Carver, Prosper Cholet, J V N Dorr, Eugene Houdry, E C Kunz, D F Othmer, A H Waitt

(Mr Alexander was one of the original founders of the American Section in 1917).

The outbreak of World War II forced the Section to become inactive and unsettled conditions in the immediate postwar period prevented resumption of activities.

The reactivation has been effected during an opportune time because of the projected international chemical festivities in September 1951 in New York and Washington. Since a large French and French-speaking delegation is expected at these meetings, all indications are that it will be the largest foreign contingent.

• Burlington Contributes $15,000 to LTI Library Fund

At a recent meeting of the AATT, Kenneth Fox, vice-president in charge of Technical Services for Burlington Mills. presented a gift of $15,000 to the Lowell Textile Institute for the Alumni Memorial Library on behalf of J C Cowan, president of Burlington Mills Corp. Martin J Lydon, LTI president, received the gift from former president Fox.

The gift was made by the foundation for the purpose of encouraging Lowell Textile Institute in the further development of its educational program in training its men for the textile industry. Burlington Mills Foundation is very much interested in getting apprentices from textile schools and has given liberally to various textile schools for several years to support their work.

NEW PRODUCTS

• Midget Psychrometer

Kearny Manufacturing Co, Kearny, N J reports ever-increasing popularity for their midget psychrometer, a portable instrument for instant determination of moisture content in textile raw materials, yarns and fabrics.

Highlights of the instrument as reported by the manufacturer are:

1. Instant moisture determination, tolerance ½ of one percent.
2. No light or power current required, works on standard batteries.
3. Easy to carry, weight only 7 pounds, dimensions 12⅛ x 6⅞ x 4¾".
4. Can be used for raw material; yarn on bobbins, quills, spools, tubes, cones, skeins and other packages or makeups.

For detailed information, write for Kearny's pamphlet #596-B.

Kearny Midget Psychrometer

• "Karbate" Pumps Now Reported Universally All-Purpose

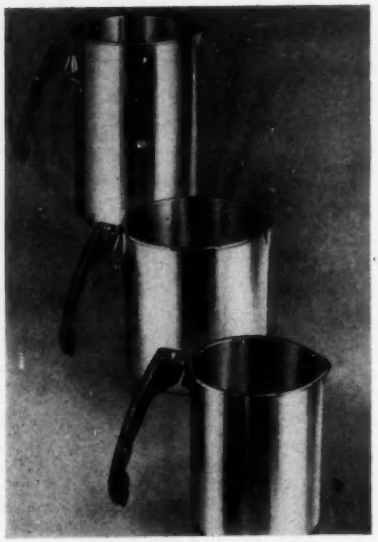
With a price reduction in "Karbate" Brand Impervious Graphite pumps, National Carbon Division, Union Carbide & Carbon Corp reports that they are fulfilling the demand for standard all-purpose corrosion resistant equipment. The new lower price, which does not include the motor, is said to permit universal application rather than the severe service in which the pumps formerly were used. "Karbate" impervious graphite is used to resist the action of acids, alkalies, salt solutions and organic compounds.

The pumps use a Teflon gasketed mechanical seal and are designed to provide low maintenance with minimum servicing and replacement parts and freedom from product contamination. They are of advance design, embodying "Karbate" impervious graphite case, impeller, and a Rotary seal that eliminates the stuffing box. Of rugged construction, they are now said to be on a par, cost-wise, with any other pump available for this type of service.

National Carbon Division is located at 30 East 42nd Street, New York 17, New York.

• Royalton S. S. Beakers

Meyer Scientific Supply Company, 221 Atlantic Avenue, Brooklyn 2, N Y has introduced the Royalton 18-8 stainless steel beaker with heavy beaded rims, "dripless" pourout lips and a Bakelite handle, which is said to remain cool during use. Available in 1, 2 or 3 liter sizes. Price: $3.90 each and up. Descriptive literature and price quotations on request.

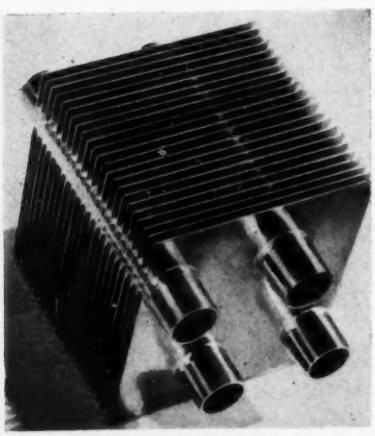


Royalton Stainless Steel Beakers

• Improved Heat Exchanger

Carpenter Steel Company, Alloy Tube Division, Union, N J announces an improved, corrosion-proof heat exchange unit, which requires no welding or soldering in the assembly. The joint is mechanical, and the manufacturer claims that it will withstand repeated expansion and contraction caused by heating and cooling cycles.

To make the exchanger, ⅛" x .049" wall stainless tubing is mechanically bonded to flat plate-type fins of stainless steel.



Corrosion-proof Heat Exchanger

PERSONNEL

DR FOSTER DEE SNELL has been appointed to the advisory commission in Chemical Technology of the State University of New York Institute of Applied Arts and Sciences.

FAY E LARRISON, a junior, and JOSEPH L CLEMENTS, a senior, have been awarded scholarships at the North Carolina State School of Textiles. Mr Larrison has been awarded the Owens-Corning Award and Mr Clements, the Textron Scholarship.

The appointment of two new assistant directors of research has been announced by the Du Pont Company's Rayon Technical Division. DR CHILES E SPARKS, an assistant manager of the Development Section, becomes assistant director of nylon research, and DR L FRANK SALISBURY, present assistant director of nylon research, becomes assistant director of acetate research.

Bertrand W Hayward, director of the Philadelphia Textile Institute, announces the addition of two new members to the faculty and staff. MRS GERALDINE R JAMES is the assistant librarian for the Hesslein Library. HARRY BIRKBY, Class of 1948 of PTI has joined the faculty to take charge of the courses in dyeing.

Mrs James was library assistant in charge of circulation for E I duPont de Nemours & Co, Inc for three years before joining the staff of the Philadelphia Textile Institute. She has taken the position left vacant when Miss Dwyer joined the library staff for NBC in New York. Mr Birkby has had experience in production dyeing with George Watt Woolen Co, Norristown; with Springfield Dyeing Co, Bordentown, N J and with the Densten Felt & Hair Co, Philadelphia.

Appointment of DR F DUDLEY CHITTENDEN, of New Haven, Conn, as factory manager of the Marvinol vinyl resin plant at Painesville, Ohio, has been announced by John C H Wendes, production manager of the Naugatuck chemical division, United States Rubber Company. Formerly development manager of the Naugatuck chemical division, Dr Chittenden joined U S Rubber Co in 1926 as a chemist in the company's general laboratories after receiving his PhD degree in chemistry from Yale University. He became development manager of the Naugatuck chemical division in 1947.

ROMAN W KULOW has resigned his position as Technical Sales Service Representative with the Textile Chemicals Department of Monsanto Chemical Co, to form his own business as a manufacturer's agent dealing in chemicals and chemical specialties and catering to the textile industry, among others. His offices are located at 24 East 28th Street, New York 16, N Y. Mr Kulow was also formerly connected with the Stauffer Chemical Co, and the Bakelite Corp.

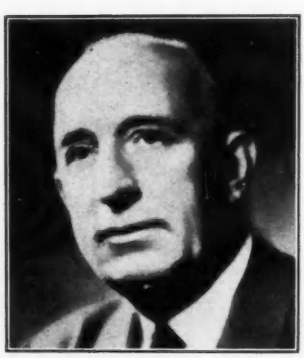
Eleanor L. Fisher

ELEANOR L FISHER has been named as director of Sears, Roebuck and Company's home economics laboratory in Chicago. Miss Fisher, senior test engineer in the Sears textile laboratory succeeds Mildred K McBride, who resigned on November 10th.

A native of Iowa, Miss Fisher joined Sears as a textile engineer in 1933 following several years' experience teaching chemistry and physics in high school and junior college.

Appointment of GEORGE W BLACKWOOD as general sales manager of the Dewey and Almy Chemical Company was announced on Dec 4 by Hugh S Ferguson, executive vice-president. Prior to his appointment to the newly created post, Mr Blackwood was general manager of the company's rubber specialties division. He joined Dewey and Almy in 1937, as a sales engineer in the company's container division and became sales manager of the division in 1945. In 1948 he was appointed assistant to the vice-president in charge of sales, T T Miller, and became manager of the rubber specialties division in 1949.

CHESTER A GAGE, Vice President in Charge of Sales, National Starch Products Inc, retired from active business on January 1st. He remains as director and con-



Chester A. Gage

sultant of National Starch Products Inc, however. A veteran of more than 35 years in the industry, he participated in much of the progress in the field of adhesives and starches.

William J. Patterson, Jr.

WILLIAM J PATTERSON, JR of Greenville, S C has been appointed field technical representative for Synthron, Inc, manufacturing chemists, of Ashton, Rhode Island. He will represent the company in North and South Carolina.

Mr Patterson comes to Synthron after nine years with Westboyd Chemical Co, in the same territory. He also spent nine years in textile finishing work with the North Carolina Finishing Co, Ware Shoals Bleachery and the Graniteville Company.

DR WAYNE A SISSON, cellulose expert of the American Viscose Corporation, has been appointed a collaborator of the Cotton Fiber Division, Southern Regional Research Laboratory, in New Orleans to serve for a four-year period which began October 1, according to Dr G E Hilbert, chief, Bureau of Agricultural and Industrial Chemistry, U S Department of Agriculture. The Southern Laboratory has under way in New Orleans, an extensive program of research directed toward expanding the usefulness of cotton.

Dr Sisson was a Fellow of the Textile Institute from 1932 to 1935, stationed at the Universities of Illinois and Leeds, a cotton technologist with the U S Department of Agriculture from 1935 to 1936, and a research chemist at the Boyce Thompson Institute from 1936 to 1940. In 1940 he joined the American Viscose Corporation, where he was made section head of the Chemical Research Department.

Dr. Wayne A. Sisson

TECHNICAL LITERATURE

"Outline of the History of Chemistry" —Mallinckrodt Chemical Works, St Louis 7, Mo—a detailed and comprehensive outline starting with the pre-Christian origins of chemistry in India, China and Egypt, and tracing the evolution of the science up to the present time. Consists of two charts (in flow sheet form) printed side by side on a 35" x 35½" sheet.

The first chart opens with the remote beginnings of the chemical science, moves into medieval alchemy, the chemistry of combustion, pneumatic chemistry, beginnings of organic and biologic chemistry, etc, and ends with the work of Lavoisier. The second chart continues the story through the beginning of the era of synthetic organic chemistry, the discovery of the elements, the modern concept of valence and molecular structure, etc, ending in 1950 with the elements Berkelium (97) and Calfornium (98).

The hundreds of entries on the two charts are arranged chronologically, with interconnecting lines to indicate relationships between men, theories, laws and discoveries. The Outline is printed in four colors, which are used to identify the main streams of chemical history. An index of names, with birth and death rates, increases the charts' usefulness.

The Mallinckrodt outline is based on an earlier unpublished version by Dr Norris W Rakestraw, editor of the *Journal of Chemical Education* and Professor of Chemistry and Head of the Chemistry Department of the Scripps Institution of Oceanography. It has been revised and brought up-to-date by Herbert S Klickstein, an editor of *CHYMIA*, the international journal of chemical history, and a member of the advisory board of the Edgar Fahs Smith Memorial Library, University of Pennsylvania. Other chemists including Dr Henry Leicester, chairman of the American Chemical Society's Division of History of Chemistry, were consulted during the preparation of the current charts.

Bordering the outline itself are illustrations of early equipment and laboratories (Agricola's, Glauber's, Becher's, etc). On the back of the outline are pictures of early chemists prominent in the development of anarytical chemistry (Paracelsus, Hoffman, Lavoisier, etc); five examples of the accomplishments of modern analytical chemistry (in the manufacture of synthetic rubber, in the development of the atomic bomb, alloying metals in steel, etc); and milestones in the development of Mallinckrodt's line of more than 400 analytical reagents (development of many laboratory chemicals, invention and use of Bell Closure bottles, steady expansion of its system of distributors, etc).

"Soda Ash" — Pittsburgh Plate Glass Company Columbia Chemical Division, 5th Ave, Bellefield, Pittsburgh 13, Pa and Southern Alkali Corporation. 64 pages. A detailed history.

Chapters are devoted to soda ash production and uses, methods of manufacture, forms and grades, unloading and handling, and other pertinent data.

An extensive technical data section, including valuable tables and charts, outlines the properties of soda ash and various methods of analysis.

A concise, four-page brochure that details the specific fields of research in which Evans Research & Development serves industry, has been issued by the corporation under the signature of S F Coneybear, vice president and development manager.

The brochure consists of over 100 detailed tabulations of Evans interests and activities, listed under 11 major headings which include: research problems, development problems, literature research, chemical engineering, production engineering, product packaging, analysis and testing, patent matters, technical sales, management engineering and other activities of the corporation.

A copy of this brochure may be obtained by request to Evans Research & Development Corporation, 250 East 43rd Street, New York 17, N Y.

Bulletin 35-G5—Omega Machine Co, Providence, R I—8 pages. A description of the Midget Belt Grimetric Chemical Feeder (Model 50-8), a small weighing feeder for dry materials with a positive nonflooding feeding mechanism, an unusual capacity and a wide feeding range. This also contains a description of the feeder and its operation as well as a thorough description of each of the component parts of this small size, high capacity dry chemical feeder. Curves show limits of accuracy to lie within plus or minus one per cent. Illustrations include various component parts of the feeder, dimension drawings, and five typical installations.

"Electro-chemograph Type E for Polarographic Analysis" — Leeds & Northrup, 4934 Stenton Avenue, Philadelphia 44, Pa—16 pages. (Ask for Catalog EM9-90(1)) Information about the recently announced polarographic equipment adaptable to operation from a standard 115-volt a-c supply circuit.

Wide applicability of the method and of the instrument is outlined in the text, and several illustrated pages show details of design and construction. Information is provided about the Leeds & Northrup Speedomax Microampere Recorder, its high-sensitivity amplifier, and the stable regulated power supply unit. A technical section is included for those acquainted with or curious about polarographic theory, describing the characteristics required for accurate and reliable recording of polarographic tests, and the embodiment of these characteristics in the instrument.

Also described is the new dropping-mercury electrode equipment designed for high mechanical stability in the performance of polarographic tests. Like the instrument itself, it is illustrated, with pictures of the available polarizing cells and a graphical demonstration of electrode performance under severe test.

"Bibliography of Recent Research in the Field of High Polymers"—National Bureau of Standards (Circular 498). Available from the Superintendent of Documents, U S Printing Office, Washington 25, D C. 20c a copy.—A reference list of both American and foreign scientific papers on high polymers. The chief divisions are those dealing with physical properties of bulk materials, solutions and gels, and reactions. Subdivisions on rubbers; plastics; fibrous materials; thermodynamics of solutions; molecular weight and size; concentrated solutions; polymerization, aging, degradation, and oxidation; and vulcanization and cross-linking are included. The American periodicals cover the period from 1946 through 1949. The English periodicals extend from 1945 through 1949; Russian periodicals from 1943 through 1949; Japanese periodicals from 1941 through 1949; and the remainder from 1944 through 1949.

"Niacet Synthetic Organic Chemicals" —Niacet Chemicals Division, 971 Niagara Building, Niagara Falls, N Y. 52 pages. Describes physical and chemical properties, latest specifications, applications, and shipping and handling information on Niacet's line of chemicals. A water-repellent treatment with Niaproof powder is described as well as data on acetic acid, sodium acetate, vinyl acetate, acetaldehyde, acetonitrile, and 12 other organic chemicals.

"Synthetic Organic Chemicals, United States Production and Sales, 1949"—(report No 169, Second Series). Available from the Superintendent of Documents, Gov't Printing Office, Washington 25, D C. 40c a copy. An annual report by the U S Tariff Commission on the production and sales of synthetic organic chemicals and their raw materials. It gives statistics on production and sales of more than 6,000 individual items and contains a list of the manufacturers of each. It also includes statistics on United States imports of products entered in 1949 under paragraphs 27 and 28 of the Tariff Act of 1930, which cover coal-tar intermediates, dyes, medicinals, flavor and perfume materials, and other finished products. Also given are the number of research workers employed in the industry, their average salaries, and the net and gross amounts spent on research by the industry.

The report comprises three major sections—chemical raw materials, cyclic intermediates, and finished chemical products. Finished chemical products are further classified according to major use as dyes, lakes and toners, medicinal chemicals, flavor and perfume materials, plastics and resin materials, rubber-processing chemicals, plasticizers, surface-active agents, elastomers, and miscellaneous chemicals.

PB 101 458, *The German Chemical Industry, A Bibliography of the Chemical, Metallurgical and Process Industries.* 396 pages. $10 per copy. Orders should be addressed to the Office of Technical Services, U S Department of Commerce, Washington 25, D C. Contains well over two thousand document references with descriptive titles or abstracts, and includes, in addition to a 6000-entry subject index, author indexes, and cross-indexes with OTS, British, and U S Military report numbers.

In addition to presenting general references on postwar conditions in Germany with regard to the chemical, metallurgical and process industries, the report gives published references for five major classifications of the German chemical industry, including dyes and pharmaceuticals; eleven classifications relating to metallurgy; and twenty relating to the process industries.

Bulletin on 12-Hydroxystearic Acid and Hydrogenated Castor Oil—Emery Industries, Inc, Dept 5—Carew Tower, Cincinnati 2, Ohio. Specifications, physical and typical characteristics of each product. Typical uses and suggested uses based on preliminary experimentation. Complete bibliography for each.

• Life Members of T.R.I. Elected

Election of a prominent group of textile executives, scientists and educators as Life Individual Members of Textile Research Institute has been announced by Dr John H Dillon, Director of Research of that organization. The list follows: Frank D Cheney, Chairman of the Board, Cheney Brothers; Donald Comer, Chairman of the Board, Avondale Mills; Dr Edward U Condon, Director, National Bureau of Standards; Dr Robert E Doherty,* President, Carnegie Institute of Technology; Franklin W Hobbs, Chairman of the Board, Arlington Mills, and Chairman of the Board, The Textile Foundation; Edward T Pickard, Secretary, The Textile Foundation; Dr Warren E Emley, Adj Professor of Chemistry, New Jersey College for Women, Rutgers; Dr Hugh S Taylor, Dean, The Graduate School, Princeton University; Dr Rhett Y Winters, Research Coordinator, Agricultural Research Administration, United States Department of Agriculture; Dr Lyman J Briggs, Emeritus Director, National Bureau of Standards, United States Department of Commerce; Dr Vannevar Bush, President, Carnegie Institution of Washington; A G Ashcroft, Director of Research, Alexander Smith and Sons Carpet Company, Inc, and President, Textile Research Institute, Inc; Dr William D Appel, Chief, Textiles Section, National Bureau of Standards, United States Department of Commerce; Dr Donald H Powers, Director of Applied Research, William R Warner and Company, Inc.

* Dr Doherty died shortly after his election to Life Membership in TRI.

SPECIAL ISSUES FOR 1951 WILL APPEAR AS FOLLOWS:

APRIL 2—KNITTING ARTS EXHIBITION NUMBER

OCTOBER 1—AATCC CONVENTION ISSUE

DECEMBER 10—ANNUAL PROCESSING REVIEW NUMBER

SANDOZ PRESENTS *The color achievement of the month*

Crepe Expectations ...BY MILLIKEN

She can be as confident of the ever-newness of the fabric's appearance as she is of the fashion-rightness of its cut.

For such fabrics as Milliken's Dress Crepe . . . 50% wool, 50% worsted . . . Sandoz offers colors of perpetual youth — fast to weather, perspiration, dry cleaning and pressing.

And to the dyers of such fabrics which, being lightweight, should be exposed a minimum length of time to the dye bath, Sandoz offers dyestuffs with maximum levelling properties. For example:

ALIZARINE LIGHT BLUE 4GL
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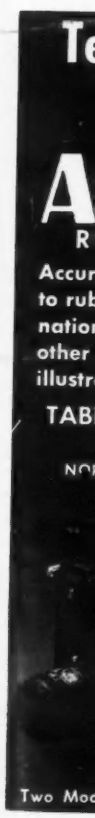
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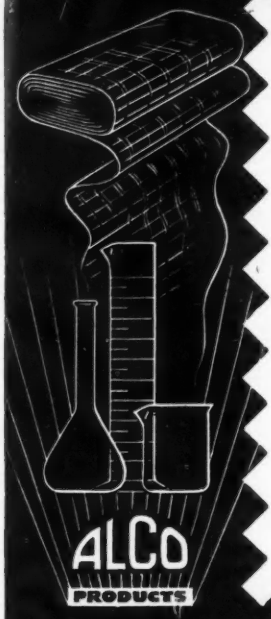

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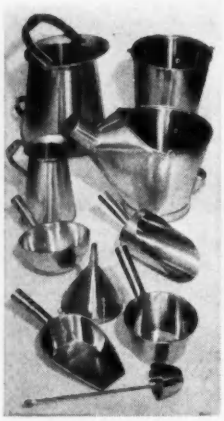

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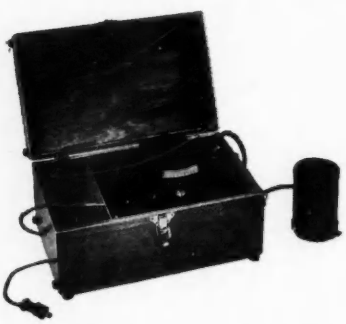

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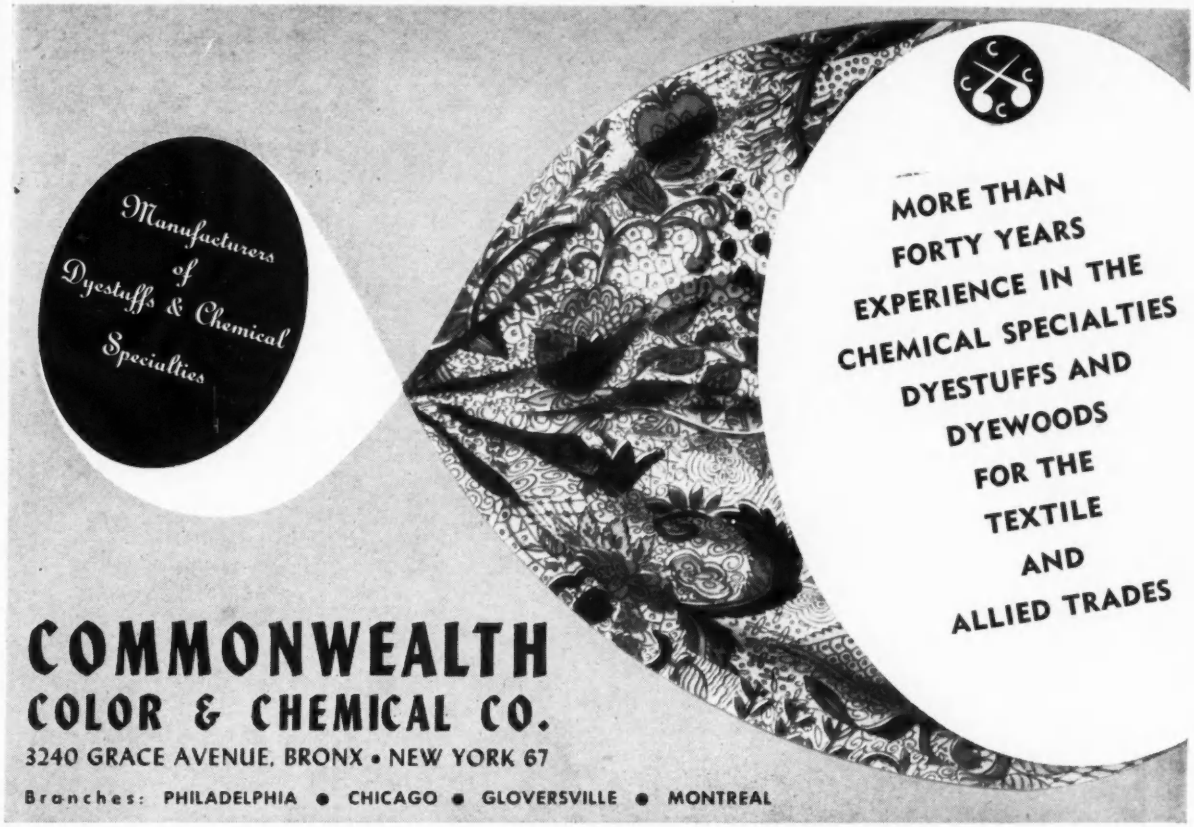
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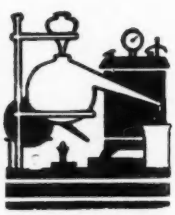

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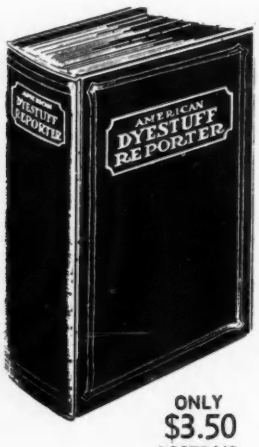

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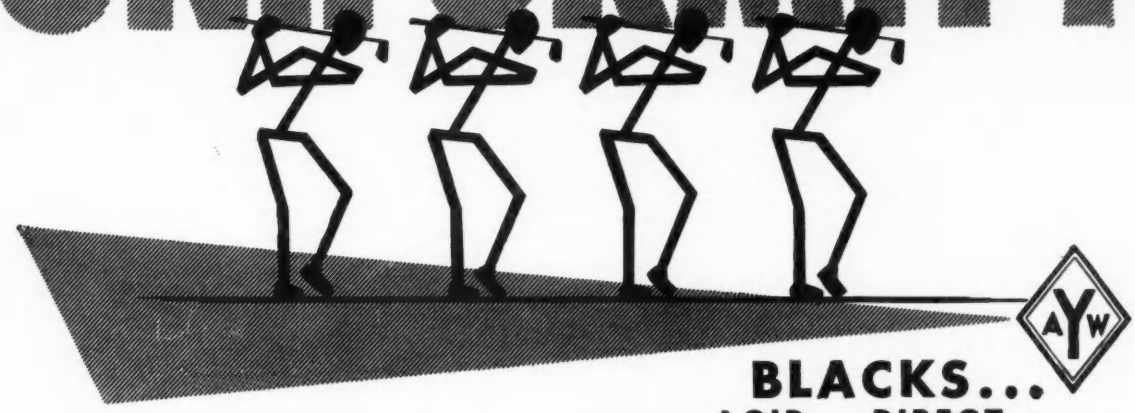

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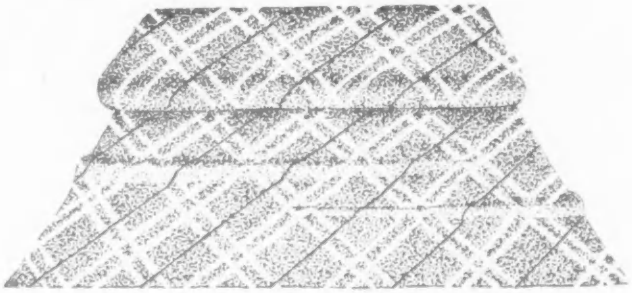

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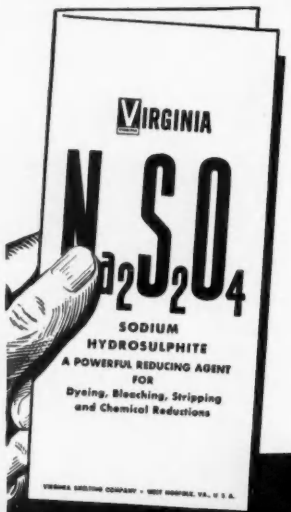

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U. S. Vanadium Corp., Unit of Union Carbide and Carbon Corp.	
Vanderbilt Co., Inc., R. T.	
Van Vlaanderen Machine Co.	XLIII
Vellner, Eugene	XXXIII
Verduin Machine Corp., John	
Virginia Smelting Co.	XLII
Wallerstein Co., Inc.	XXIII
Warwick Chemical Co.	XXI
Winthrop-Stearns, Inc.	
Wolf & Co., Jacques	
Wyandotte Chemicals Corp.	
Young Aniline Works, Inc.	XXXIX
Young Co., J. S.	
Zinsser & Co., Inc.	
Zurn Company, O. F.	

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XIV
XXXVI
XLI
XXX
XVIII
IV
XXII
XXXVI
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XXXIX
Back Cover
XXXI
Third Cover
XXXVI
XXXIII
XLIV
XXV
XXXIX
XLIII
XXXIII
XLII
XXIII
XXI
XXXIX

How is Quality Measured?

Because of today's uncertain world conditions, your textile equipment may again have to be put to work on emergency schedules. The measure of its quality may be its ability to operate for long, continuous periods at peak production.

We invite your comparison of the Van Vlaanderen INSPECTALL with competing makes. The INSPECTALL has been purposely engineered to outlast and out-perform them all. Compare its features, point by point, as shown in the column at the left.

VAN VLAANDEREN INSPECTALL

COMPARE

these features with those of any other make

- Built to a precision and sturdiness not before available.
- Exclusive design, one-station group control for easier, faster operation.
- Wide-range, variable speed control at operator's finger tips.
- Instantly reversible, one motion clutch control, hand operated from any examining position.
- Let-off tension arrangement controlled from front of machine.
- Any fabric can be examined face or back because take-ups operate clockwise or counter-clockwise.
- Center bar quills are ball-bearing mounted with opposite end equipped with new, Van Vlaanderen positive center-bar lock.

This new, superior examining machine will handle rolls up to 36" in diameter. Examining board is 36" high in widths for 60" and 70" cloth. Special widths available. Machine is equipped with precision clock, measuring yards and eighths from shell to shell. Attachment (optional) available for running tube to tube or shell to tube.

The INSPECTALL is equipped with ball bearings throughout . . . sealed in for life. Drive is completely enclosed. Oversize dry disc clutches. Hard chromium-plated guide rolls.

You are invited to see this quality machine. We also make a tubing and measuring machine, a combination tubing and doubling machine and a roll make-up beaming machine.

VAN VLAANDEREN MACHINE COMPANY

You are invited to see this machine.

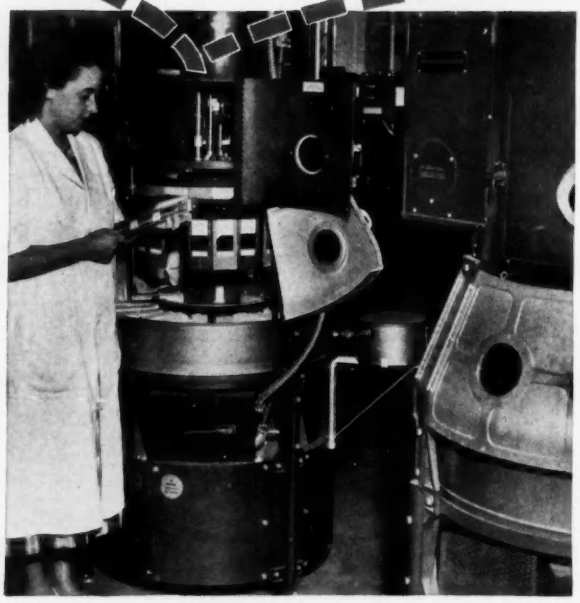
370 Straight Street, Paterson 3, New Jersey

Cable address: **VLAANDEREN, Patersonnj, U. S. A.**

World's largest manufacturer of machines for processing modern fabrics

ATLAS-OMETERS

. . . helping to maintain famous Bur-Mil quality



Atlas Fade-Ometers and Launder-Ometers are in constant use in the modern laboratories of the Burlington Mills Corporation, serving two important functions — quality control and progressive research.

To assure unvarying quality in daily production, fabric samples from each phase of processing are subjected to exhaustive tests in Fade-Ometers and Launder-Ometers. These tests help to determine color fastness, bleeding, shrinking, and resistance to washing and mechanical action. Samples that fall short of the high Bur-Mil standard result in rejection of the entire lot.

Bur-Mil designers, also, use these Atlas-Ometers when experimenting with new fabrics. Because the Fade-Ometer so accurately duplicates the deteriorating effects of sunlight, and the Launder-Ometer the effects of commercial laundering, designers can ascertain in the laboratory whether fabrics will withstand actual use satisfactorily.

The machines are adaptable to a wide range of products. They are simple to operate, and may safely be left in continuous, unattended operation.

ATLAS ELECTRIC DEVICES COMPANY
361 West Superior St., Chicago 10, Ill.

WEATHER-OMETERS • FADE-OMETERS • LAUNDER-OMETERS

TENNESSEE CORPORATION

SULFUR-DIOXIDE

HIGHEST QUALITY

SO_2

FOR COMMERCIAL USE

One of the newer chemicals with hundreds of uses. Economical and convenient to use.

BLEACHING AGENT

For paper pulp, textiles, many food products, minerals and other materials.

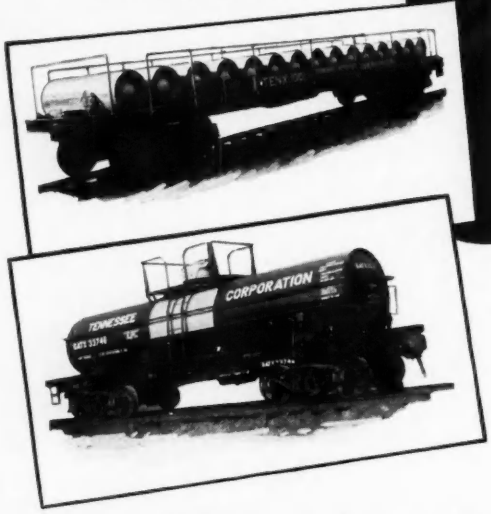
DECHLORINATING AGENT

Removes excess chlorine in paper pulp, in laundries and in textile bleaching.

CHEMICAL PROCESSING

SO_2 has many uses in chemical processing such as oil refining, manufacturing of plastics and as a leather tanning agent.

CYLINDERS
TON DRUMS
TANK CARS



Let us consult with you on the various ways that Sulphurs Dioxide can be economically and efficiently used in your business.

TENNESSEE CORPORATION
601 GRANT BUILDING ATLANTA, GEORGIA

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SHELLEY WINTERS

Starring in "Frenchie"

a Universal-International picture,
color by Technicolor

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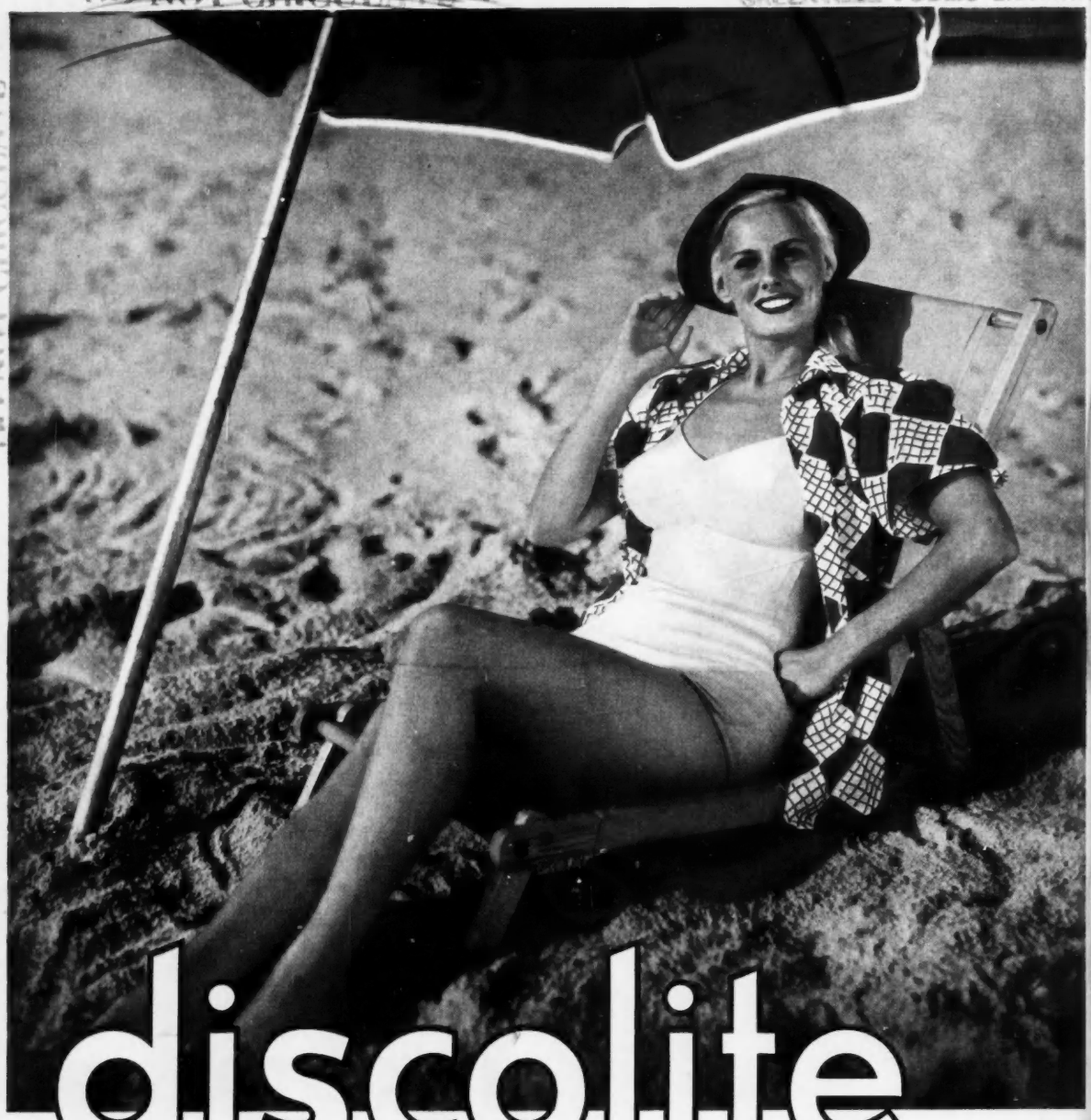

discolite©

Concentrated Sodium Sulphoxylate Formaldehyde

Stable at high temperatures, Discolite is most effective as a reducing agent to effect solubilization of the vat color . . . is highly useful when the process calls for the reducing agent to be dried into the fabric as in printing without loss of its reducing properties.

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